

**TETRA TECH**



## **SUPERVISORY CONTRACTOR QUALIFICATIONS REMEDIAL DESIGN SERVICES**

Regional Focus  
Lower Passaic River

### **PRESENTED TO**

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**Glenn Springs Holdings, Inc.**  
5 Greenway Plaza, Suite 110  
Houston, TX 77046-0521

### **PRESENTED BY**

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**Tetra Tech, Inc.**  
6 Century Dr. 3rd Floor  
Parsippany, NJ 07054

P +1-973.630.8000  
F +1-973.630.8165  
[tetratech.com](http://tetratech.com)

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## 1.0 COMPANY PROFILE

Tetra Tech, Inc. (Tetra Tech) is a leading provider of specialized management and technical engineering, remediation, construction, infrastructure, and regulatory consulting, with annual revenue of over \$2 billion. We have approximately 16,000 associates located at more than 330 offices worldwide who provide a broad range of technical skills and project management experience in hazardous and industrial waste cleanup projects.

Our strength is in collectively providing integrated services—delivering the best solutions to meet our clients' needs. As Engineering-News Record's #1 environmental management firm, Tetra Tech has implemented some of the most innovative cleanup solutions within the industry for contaminated soil, groundwater, surface water, and sediment. This statement of qualifications presents Tetra Tech's market-leading experience and qualifications in all of the areas that Glenn Springs Holdings, Inc. (GSH), a subsidiary of Occidental Petroleum Corporation, and the United States Environmental Protection Agency are looking for in a partner:



Tetra Tech  
Rankings

- 1** Water
- 1** Dams & Reservoirs
- 1** Environmental Management
- 1** Environmental Science
- 1** Solid Waste
- 1** Treatment/Desalination
- 1** Wind Power
- 7** Design Firms

- **Environmental remediation** – Tetra Tech has successfully completed remediation of some of the most complex sites. Project descriptions in Appendix A demonstrate our use of state-of-the-art remediation approaches and exit strategies and providing for site beneficial reuse. Numerous projects that we have implemented have included cost reduction strategies that have reduced the cost of implementation while maintaining regulatory compliance.
- **Strong Relationship with EPA and State Regulatory Agencies** – Tetra Tech is trusted by the regulatory agencies throughout all EPA regions and the regulatory agencies in all 50 states, US territories, and regional and local districts. This trust is critical to achieve progress on complex sites and/or contentious situations. We have a very solid relationship with EPA Region 2 and New Jersey Department of Environmental Protection (NJDEP).
- **Local Presence** – Tetra Tech Parsippany, NJ office is located in the Passaic River watershed and near the Operating Unit 2 project site in the Passaic River. The Figure below shows our offices in New Jersey.

### Why our Clients Choose Tetra Tech

- 50 years providing environmental and infrastructure services to our customers
- More than 2,000 environmental remediation projects totaling over \$5 billion
- Strong working relationships with US EPA and State Regulatory Agencies
- Large staff with diverse relevant experience

Tetra Tech offices are strategically located in close proximity to the GSH sites as identified n the map below.



## 2.0 RECENT INNOVATIVE & SUCCESSFUL REMEDIATION IMPLEMENTATION

Tetra Tech offers a full range of professional services related to environmental compliance, groundwater contaminant characterization, and remedial design engineering. Furthermore, we have the experience and expertise with “green” technologies and sustainable business practices to execute these services with consideration to the net effect on the environment. Tetra Tech’s innovative remedial design expertise includes the following to meet both cost and sustainability objectives:

- Reviews of operating remedies and remedy designs for cost-effective and efficient operation
- Proven in-situ and ex-situ remedial technologies (e.g., in-situ bioremediation)
- Innovative remedial technologies to shorten remedial time frames
- Proven energy efficiency technologies that have been used in other fields such as combined heat and power, water source heat pumps, and high efficiency motors
- Optimization of system flow rates to reduce groundwater extraction to minimize both groundwater use and the carbon footprint associated with extracting and treating the water
- Targeted characterization to minimize areas for aggressive remediation
- Beneficial reuse of water and materials from remedial activities
- Renewable energy to power remedies
- Evaluation of surrounding habitat

### Remedy System Evaluations & Optimizations

Tetra Tech has utilized the USEPA Remediation System Evaluation (RSE) process and Independent Design Review (IDR) process to conduct remedy optimization evaluations. Tetra Tech has conducted nearly 100 RSE evaluations at Superfund sites nationwide. These reviews identify cost-saving and energy-saving measures such as eliminating unnecessary treatment components, addressing oversized motors, and reducing extraction rates. Tetra Tech continues to provide these reviews for USEPA and now includes a comprehensive Green Remediation Evaluation that is consistent with the USEPA Green Remediation Primer and focuses on the following areas:

- Reducing energy requirements of the treatment system and considering use of renewable energy to reduce the overall carbon footprint (or greenhouse effect potential) of the remedy
- Reducing emissions of air pollutants
- Conserving water and reducing impact on local water resources
- Minimizing disturbance to local habitat
- Minimizing waste generation by reducing material consumption, reusing materials, and recycling materials
- Considering long-term stewardship actions

The reviews consider the baseline effect of the system on the environment as it currently operates and refer to this baseline to identify those aspects of the system that, if modified, could have a substantial positive impact on the above areas. Specific recommendations are made to help realize those positive impacts

### Experience Partnering & Working with USEPA and State Agencies

Tetra Tech program management and project personnel are involved with formal or informal partnering initiatives for projects within all USEPA Regions. We have terrific and applicable experiences in USEPA Region 2 and NJDEP. Project teams are comprised of clients, USEPA and State regulators, and other contractors. The “team

concept” is a key to many of our successes. It has provided a forum for open discussion and innovation and has fostered trust among the stakeholders. We develop exit strategies for each site and work toward those goals as a team. The professional relationships that we have built are based on trust and allow Tetra Tech to achieve stakeholder buy-in on technical approaches and recommendations. This has led to overall cost savings and schedule reductions for our clients.

Tetra Tech has the in-house staff in local offices to develop and initiate on-the-ground studies to fully characterize the extent of contamination as the foundation for developing cost-effective alternatives for sediment remediation projects, which may include any or all of the following:

- Remedial Investigation Studies
- Water Quality
- Hydrographic and Geophysical Surveys
- Hydraulic and Sediment Transport Studies
- Human Health/Ecological Risk Assessment
- Fluvial Geomorphology
- Marine Structure/Geotechnical Assessments
- Sediment Quality
- Source Control/Outfall Studies
- Hydrodynamic Modeling
- Contaminant Mobility and Sediment Toxicity Testing

From concept through completion, our multidisciplinary team develops remedial alternatives to address remediation of contaminated sediments. This process includes determining the financial and environmental feasibility of alternative approaches to site remediation.

- Feasibility Analysis
- Remedial Design Plans
- Port/Marine Development
- Pilot Studies
- Dredge Material Handling and Disposal
- Habitat Restoration

Please see Appendix A for Project Descriptions, which address a number of successful sediment, groundwater, and soil solutions for various projects. In addition, Appendix C has our Sediments Brochure, and Appendix D contains a presentation developed to describe the success of several contaminated sediment management projects.

### 3.0 KEY PERSONNEL

Please see Resumes in Appendix B for key staff with specific relevant project experience in New Jersey and Ohio.

## 4.0 HEALTH AND SAFETY

Safety is of paramount concern to Tetra Tech. We draw upon our well-established Corporate Health and Safety Program that Tetra Tech has built over the lifetime of our firm. Beyond this, safety is built into each project, which has its own site-specific Environmental Safety and Health (ES&H) Plan designed specifically for activities performed on each project.

Our project teams integrate Tetra Tech's ES&H Program into all aspects of its work, which provides assurance of adequate protection of the worker, public, and environment. All hazards are identified and categorized through workers' involvement; hazard analyses are performed; hazard controls are implemented; and work is performed safely in compliance with approved procedures, programs, and plans. Continuous improvements by employees, clients, and other subcontractors are encouraged through identification and sharing of lessons learned.





## APPENDIX A: PROJECT DESCRIPTIONS

**CLIENT:** Confidential Client

## Fox River Sediment Remediation Green Bay, Wisconsin

### PROJECT HIGHLIGHTS:

- Achieved a total of 1 million hours without a lost time incident
- Just 14 months after initial contract award, Tetra Tech met UAO requirement to begin full-scale remediation
- Received approval for each of the 28 major deliverables submitted to the regulatory agencies in the 14-month schedule
- Initiated an Adaptive Management/Value Engineering Program geared to generate over \$100 million in project savings in the 10-year implementation period

*"[Tetra Tech] performed a miracle for us with this design build. When ground broke in late June 2008, every stakeholder and oversight entity claimed the contractor could never erect the processing facility and have it work in time for a May 1, 2009 start-up. Undaunted, the contractor worked to achieve what all regarded as impossible. Seldom does a contractor deliver such an exceptional performance under harsh time constraints, miserable weather conditions, and the constant naysaying of stakeholders and oversight teams."*

*-Brian Tauscher, General Counsel for Argo Wiggins Appleton Ltd., Group, March 2010*

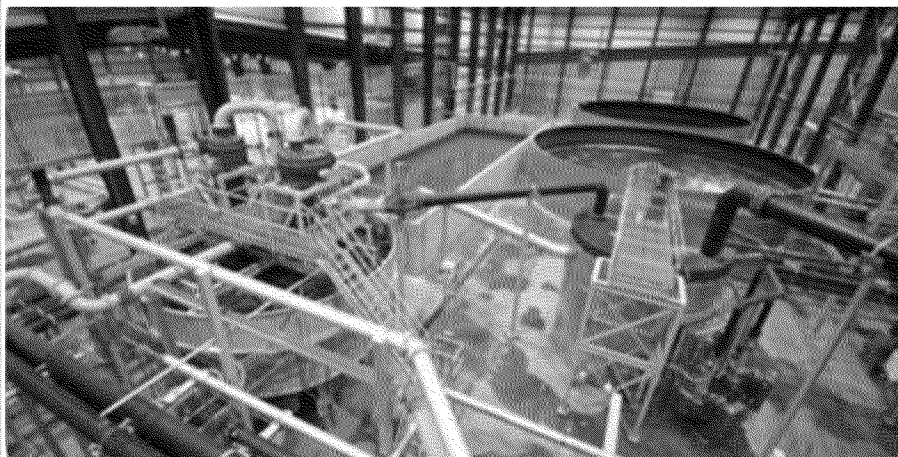
Tetra Tech is performing a sediment remediation project along a 13.3-mile reach of the Lower Fox River in Green Bay—the largest sediment remediation program awarded in the U.S.

### Project:

- Successful Union Staffing
- Processing Facility
- Dredging and Dewatering Equipment
- Sediment Remediation

### KEY FEATURES

- Entails the removal of 3.5 million cy of PCB-impacted sediment for a 13.3-mile reach of the river and placement of nearly 600 acres of capping material to remediate another 4.1 million cy of impacted sediment
- Achieved a total of 1 million hours without a lost time incident
- The Tetra Tech team established an outstanding business relationship with the unions. Each day there were over 300 construction personnel on-site during process building construction in 2008 and 2009
- Met UAO requirement to begin full-scale remediation by May 2009, which was just 14 months after initial contract award
- Completed remedial design concurrent with performance of remedial construction
- Received approval for each of the 28 major deliverables submitted to the regulatory agencies in the 14-month schedule
- Initiated an Adaptive Management/Value Engineering Program geared to generate over \$100 million in project savings in the 10-year implementation period

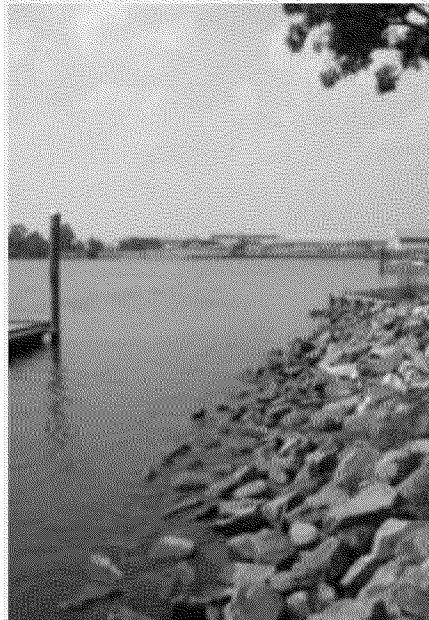




**CLIENT:** Lockheed Martin

## Middle River Remedial Investigations and Feasibility Study

### Middle River, Maryland



Tetra Tech was contracted to perform site characterization investigations and risk assessments to provide the information on the nature and extent of contamination, the nature of ongoing sources of contamination, the physical and chemical properties that influence the fate and transport of contaminants found at the site, and the risks to human health and the environment. Tetra Tech also conducted a feasibility study that describes and evaluates a range of remedial alternatives to address site risks through remediation of sediment contamination at the site. A recommended alternative for a final remedy is also provided in the feasibility study. Ongoing pre-design work includes evaluating the placement of activated carbon to the surface sediments in some areas to reduce the bioavailability of PCBs and metals (including mercury).

#### Project:

- Contaminated Sediment and Surface Water Investigations
- Bathymetry Survey
- Human Health and Ecological Risk Assessments of Sediment Contamination
- Surface Water and Sediment Investigation Frog Mortar Creek
- Feasibility Study
- Amendment Capping
- Benthic Community Analysis
- Passive Sediment Porewater Sampling

#### KEY FEATURES

- Remedial investigations including collection and analysis of sediment and tissues samples, geotechnical samples, hydrodynamic modeling, human health and ecological risk assessments
- Evaluation and planning for innovative in situ sediment remediation technologies using reactive amendments
- Benthic community sampling and assessment; sampling of sediment porewater for PCBs using passive samplers
- Feasibility study based on risk-based RAOs and PRGs; evaluated a range of alternatives; selected a combined action remedy
- Overcame challenges associated with dense bottom vegetation
- High-resolution multibeam bathymetric survey provided data to support remedial investigation for contaminated sediments



**CLIENT:** Lockheed Martin

## Middle River Sediment Remedy Design, Cow Pen Creek Restoration Middle River, Maryland



Manufacturing activities, conducted along the Middle River since the 1920s, have resulted in contaminated sediments in some areas creating bioavailable PCBs and metals (including mercury). Tetra Tech performed site characterization investigations to determine the nature and extent of contamination, including bathymetric data collection, geotechnical sampling, and ecological and human health risk assessments. Tetra Tech also conducted a feasibility study evaluating a range of remedial alternatives to address site risks. The recommended remedy included contaminated sediment removal from Cow Pen Creek (CPC). Additionally, Tetra Tech performed the 30% design for the full sediment remedy. Tetra Tech was also awarded the 100% Design for the full sediment remedy at the Middle River Complex. The 100% Design included excavation of the contaminated sediment in CPC followed by restoration of the creek by stabilizing and revegetating for the proposed conditions.

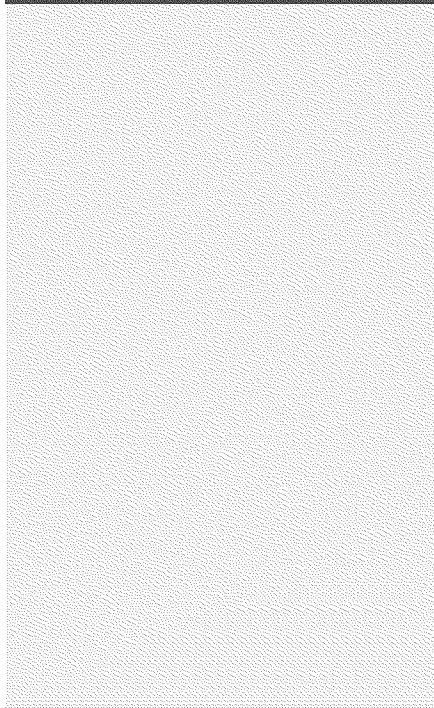
### Project:

- Contaminated Sediment and Surface Water Investigations
- Topographic Stream Survey
- Stream depth and flow measurements
- Hydraulic Modeling
- Proposed Creek Restoration Design

### KEY FEATURES

- Remedial investigations including collection and analysis of sediment and tissues samples, geotechnical samples, hydrodynamic modeling, human health and ecological risk assessments
- Topographic stream survey
- Hydraulic measurements of stream flow and water surface level
- Hydraulic modeling of existing and proposed conditions
- Proposed civil engineering design:
  - rebuilding existing floodplains and tidal flats
  - large wood structure design
  - restoring of impacted wetland areas
  - bank stabilization and revegetation

<b>CLIENT:</b> New Jersey City University	<b>New Jersey City University, West Campus Expansion Construction Management/ Oversight Jersey City, NJ</b>
	<p>The New Jersey City University (NJCU) West Campus Expansion site is located on a former mercurial product manufacturing facility, a former steel and warehouse facility, and a former railroad spur. The site is a rectangular 21-acre parcel that fronts NJ Route 440 and West Side Avenue in Jersey City. The site soils are contaminated with mercury, volatile and semi-volatile organic compounds and heavy metals, and the groundwater is contaminated with carbon tetrachloride and metals. Early in the process, Tetra Tech was tasked with completing a Phase I Assessment on an adjoining property, Baldwin Steel.</p> <p>Tetra Tech is currently providing NJCU with project and technical management for all environmental, demolition, and remedial design activities related to the West Campus Expansion and redevelopment. Tetra Tech is the prime environmental consultant for the West Campus Redevelopment. As the prime consultant, Tetra Tech is responsible for all matters concerning the NJDEP, reviewing architectural and infrastructure drawings for compliance to the existing environmental conditions and directing investigation, remedial, geotechnical, and demolition activities. NJCU has developed a conceptual design plan for a mixed-use redevelopment of this 21-acre Brownfields site. Tasks have included:</p> <ul style="list-style-type: none"> <li>• Raising the topography of the site eight feet in an area contaminated with mercury to eliminate the need for off-site soil removal during building foundation installation and to add an area for an underground stormwater detention basin.</li> <li>• Utilizing the Triad approach for rapid site characterization.</li> <li>• Performing foundation demolition and soil remediation during infrastructure construction to minimize remediation costs.</li> <li>• Providing technical oversight concerning the third-party cleanup of on-site chromium-impacted soil that resulted from the former operations of an adjacent bichromate manufacturing plant that operated for approximately 75 years.</li> <li>• Providing technical reviews and risk mitigation measures for the indemnification agreement with the third party.</li> <li>• Prepared Environmental Impact Statements for the redevelopment, including a Stage 1A Archeological Survey.</li> </ul> <p>As the owner's representative, Tetra Tech is responsible for managing all activities during remediation, including:</p> <ul style="list-style-type: none"> <li>• Preparation of remedial estimates for financial support of the overall project development. Prior to the final property transaction, Tetra Tech provided several remedial cost models for the development.</li> </ul>



- Provided construction management and technical oversight for the demolition of six former industrial buildings. Three buildings were used for mercurial-product manufacturing and the other three were used for iron and steel warehousing. The steel warehouse was six acres in size and constructed of corrugated steel walls and roof with steel trusses. The walls and roof panels were coated with asbestos and lead paint. These buildings contained both friable and non-friable asbestos and lead paint.
- Performed pre-demolition characterization, including asbestos, lead, and mercury surveys and universal and hazardous waste inventories, transport, and disposal.
- Provided oversight of the building abatements and demolition activities.
- Provided independent third-party air monitoring during demolition activities for asbestos, lead, chromium, and mercury particulates.
- Prepared remedial design and construction bid documents.
- Provide construction oversight and perimeter air monitoring support during remediation and civil infrastructure construction activities (in progress).

**CLIENT: Ullrich Copper, Inc.****Ullrich Copper, Inc.  
Kenilworth, NJ**

Tetra Tech conducted four Industrial Site Recovery Act (ISRA) investigations in accordance with ISRA and NJAC 7:26E, *Technical Requirements for Site Remediation* simultaneously for four separate, but contiguous, properties in Kenilworth, New Jersey. This work is being conducted under the LSRP Program, with Edward Huss the LSRP of record. The properties were formerly operated as a specialty producer of high-conductivity copper used in the electronics industry. Our activities included:

- **Preliminary Assessment** – A site reconnaissance was performed to determine if potential routes of contamination were present at the four properties. Potential routes identified included USTs, dry wells, sumps, pits, floor drains, and areas of discoloration and/or staining, as well as previous waste management practices.
- **Site Investigation** – Tetra Tech investigated the four properties to determine if the potential contamination migration had impacted the site and surrounding properties. Surface and subsurface soil and groundwater samples were collected. Copper was identified throughout the properties as the primary contaminant of concern in soil, and chlorinated solvents, including perchloroethylene and trichloroethylene, were identified in the groundwater.
- **Remedial Investigation** – Tetra Tech performed the RIs to determine the characteristics of the site, and determine the nature and extent of contamination both on- and off-site. The scope of the RIs included underground utility surveys, direct push soil borings, groundwater screening evaluation, borehole and monitoring well installation, hydraulic testing and groundwater sampling, land surveys, and investigation-derived waste characterization and disposal. An expanded network of groundwater monitoring wells was installed to evaluate the regional groundwater. Based on the data collected from this network, it was determined the chlorinated solvents detected in the groundwater are probably associated with other industrial entities hydraulically upgradient of the properties, and not attributable to the former owner.
- **Site-Specific Alternate Remediation Criterion Development** – Tetra Tech collected surface and subsurface soil samples for Synthetic Precipitation Leaching Procedure (SPLP) analyses to develop an argument for a site-specific Alternate Remediation Criterion (ARC) for copper. Tetra Tech collaborated with NJDEP personnel from multiple Bureaus to ascertain the proper sampling

frequency, methodology, and laboratory analytical procedures to develop a scientific, justifiable argument based on our site-specific understanding of copper impacts on the surrounding environment. The ARC was granted, and Tetra Tech's sample collection, analyses, and risk assessment arguments were subsequently used by NJDEP to revise the state-wide soil remediation standard for copper in soil to coincide with the site-specific ARC.

- **Baseline Ecological Evaluation** – A Baseline Ecological Evaluation (BEE) was conducted to evaluate the data identified or collected in the Preliminary Assessment and Site Investigation to identify the site-specific contaminants that are of ecological concern, as well as examine the site for the co-occurrence of contaminants of potential ecological concern (COPECs), environmentally sensitive areas, and chemical migration pathways to the sensitive areas. The BEE presented the results of surface water, sediment, and soil samples collected from an adjacent county park and pond to determine the extent and magnitude of contaminants of concern (COCs) previously detected in the off-site county park and pond, and identify potential sources of contamination. NJDEP concurred the COCs detected in the adjacent county park and pond were not attributable to on-site activities; therefore, remediation at the county park and pond was not required.
- **Receptor Evaluation** – A Receptor Evaluation was conducted to document the existence of receptors and the actions taken to protect receptors. On-site and surrounding land use, regional groundwater use, potential vapor intrusion pathways, and ecological receptors were examined to evaluate the adequacy of onsite protective measures. This evaluation included completion of a vapor intrusion study in several buildings at the project site.
- **Remedial Actions** – Tetra Tech conducted several phases of Interim Remedial Measures and Limited Remedial Actions at the site, including underground storage tank removal and contaminated soil removal to approximately 20 feet below ground surface. The execution of several of the remedial activities was complicated due to the fact the property is currently owned and operated by other industrial companies. Tetra Tech was able to perform remedial activities while minimizing the impact to on-site and neighboring light industrial operations.
- **Community Relations** – Tetra Tech notified the public of investigation and/or remediation activities at the properties in accordance with the NJDEP Notification and Public Outreach requirements. Tetra Tech provided notification letters to the surrounding community and local newspapers that explained the

environmental activities currently being performed, as well as summarized activities previously performed.

- **Deed Notice** – Tetra Tech developed a Deed Notice for one of the properties to address residual soil contamination remaining after the conclusion of remedial activities. The Deed Notice was instituted to document the presence, location, and level of constituents remaining onsite in excess of unrestricted use soil remediation standards. The Deed Notice also established institutional controls to protect onsite personnel and prevent accidental contact with the remaining contamination.

**CLIENT: Chemtura Corporation****Chemtura Corporation  
Perth Amboy, NJ**

Since 1993, Tetra Tech has been providing environmental engineering, construction oversight, and support of regulatory agency negotiations for Chemtura Corporation's Perth Amboy, New Jersey facility-wide remediation of polychlorinated biphenyls (PCBs). This work has been performed in accordance with a Stipulation of Settlement with close monitoring from environmental groups and local citizens. The 44.7-acre active manufacturing facility contained PCB-contaminated soil and sediments with concentrations as high as 5,000 parts per million. Tetra Tech developed the Remedial Action Work Plan for the site-wide PCB remediation program to comply with all USEPA Region 2 and NJDEP regulations. Semi-annual monitoring of site groundwater has been performed since 1995.

In preparing the Remedial Action Work Plan (RAWP) and in order to refine the remediation limits, Tetra Tech performed both a geophysical survey and excavation of test pits. The geophysical survey utilized ground penetrating radar equipment and resulted in the identification of 45 individual test pits for intrusive investigation. The geophysical survey identified areas having buried drums and provided a quick, non-intrusive and safe approach to minimizing areas of excavation.

As part of the RAWP, an estimated 31,000 tons of PCB-contaminated soil and sediment (15,000 tons TSCA-regulated and 16,000 tons of non-TSCA regulated) were excavated and disposed of at permitted facilities. Tetra Tech developed engineering drawings and specifications, supported subcontractor procurement, reviewed subcontractor and disposal facility submittals, inspected construction activities, monitored compliance with safety and quality programs, and reported regularly to the USEPA and NJDEP and project-related matters.

Chemtura maintained a stormwater collection system and discharge outfall in accordance with New Jersey Pollutant Discharge Elimination System (NJPDES) requirements. The RAWP identified the need to close this outfall and redirect stormwater flow across the site. Tetra Tech engineered and permitted the closure of the outfall as well as the new drainage swale and discharge.

Tetra Tech supported the last phase of PCB remediation at the facility. A focused RAWP was prepared for the remediation of PCB contaminated soil underlying concrete pads in a complex process area. The plan complied with new NJDEP Technical Requirements as well as anticipated USEPA TSCA regulations. USEPA approved of an excavation approach which could leave residual levels of PCBs in subsurface soils in excess of TSCA standards. After NJDEP approved the plan, Foster Wheeler



supported subcontractor procurement, inspected construction activities, analyzed samples, and prepared the final Remedial Action Report (RAR).

The RAR documented the successful implementation of all remedial activities and satisfied other NJDEP requirements. Groundwater modeling was performed to substantiate a Classification Exception Area (CEA) and natural attenuation of contaminants. A Deed Notice was prepared to document the residual levels of contaminants across the site and notify the public of the final disposition of remedial actions. As a result of the work performed by Tetra Tech, NJDEP issued a No Further Action (NFA) determination.

Tetra Tech has provided support to assist Chemtura with complying with evolving New Jersey Department of Environmental Protection (NJDEP) regulations. Tetra Tech was instrumental in obtaining approval for a Classification Exception Area (CEA) for groundwater contamination at the Perth Amboy facility. A Deed Notice was prepared to document the residual levels of contaminants across the Perth Amboy facility and notify the public of the final disposition of remedial actions. As a result of the work performed by Tetra Tech, NJDEP issued a No Further Action (NFA) determination for soil. Tetra Tech continues to support Chemtura's Perth Amboy facility with biennial Deed Notice and CEA inspections and reporting, as well as performing annual groundwater monitoring and reporting to the NJDEP in support of the CEA. In 2011, Tetra Tech assisted with the preparation of a Receptor Evaluation for the Perth Amboy facility.

Tetra Tech supports Chemtura in complying with the Perth Amboy facility's New Jersey Pollutant Discharge Elimination System (NJPDES) permit. Tetra Tech performs quarterly stormwater sampling at multiple outfalls during rain events and prepares the required Surface Water Discharge Monitoring Reports. In addition, Tetra Tech performs 24-hour composite and grab sampling for multiple parameters as required by a local municipality for wastewater discharge at both the Perth Amboy (quarterly) and Fords (monthly) facilities in New Jersey. Tetra Tech prepares the Self-Monitoring Reports on behalf of Chemtura and provides support to Chemtura during facility audits.

In 2012, Tetra Tech performed a third-party audit of three Chemtura manufacturing facilities in New Jersey to evaluate their existing Discharge Prevention, Containment, and Countermeasure (DPCC) and Discharge Cleaning and Removal (DCR) plans. Inspections of the facilities to determine compliance with the established plans and applicable regulations was conducted. Findings and recommendations for improvement were provided to the three facilities. Tetra Tech then conducted an on-site DPCC training course for the environmental management personnel for the three New Jersey facilities.



## David's Island HTRW Remediation and Demolition, USACE New England District New Rochelle, NY

Tetra Tech executed a \$24.9 million remediation task order that included demolition of 94 abandoned buildings, structures, and related infrastructure on Davids Island, New Rochelle, NY. This environmental project included a range of elements to facilitate demolition/restoration: soil sampling to identify nature/extent of PCB contamination; asbestos abatement and disposal; topographic surveys; installation of support facilities, including a temporary pier to access the Island; building and structure demolition and excavation to a consistent grade; T&D to off-site facilities; metal recycling; excavation and disposal of PCB contaminated soils; and air monitoring. We continuously suppressed dust during asbestos handling, and characterized and segregated wastes for disposal. A minimum 50-ft exclusion zone was established during demolition due to HTRW/asbestos. A mobile decontamination unit was moved to each asbestos abatement area to facilitate decontamination activities. In total, 516 roll-off containers were required for waste disposal, as well as disposal of PCB-contaminated transformers.

Tetra Tech also conducted extensive cultural and environmental assessments to evaluate demolition impacts and develop mitigation measures to avoid significant impacts, and document the historic and archaeological resources. Cultural resource studies included extensive building research and documentation including video and photographic documentation, oral histories, landscape inventory, and preparation of a virtual archive exhibit, displayed on the Westchester County Virtual Archive web site that documents the history of Davids Island and Fort Slocum.

Numerous measures contributed to a \$2 million budget savings (used by USACE to fund other work), including beneficial use of naturally decomposed vegetation and mulched grub as restoration topsoil cover and use of processed concrete and brick from demolition to fill foundations to grade; both avoided capital outlays for materials, handling costs, and fuel use. It also restricted T&D to asbestos, wood, glass, and metal.

Tetra Tech cooperated with local union shops for union labor and the City of New Rochelle, NYSDEC, and NYSDOH during restoration to ensure coordination of demolition activities with ongoing site investigations and subsurface contamination remedial actions conducted by the City and NYSDEC. Multiple state inspections by the NYS Department of Labor yielded full compliance with all applicable regulations and standards.

RAs were conducted concurrently with the demolition activities:



	<ul style="list-style-type: none"> <li>• Closure of two USTs. We performed excavation and field screening of surrounding soil, vacuum extraction of contents, inspection of walls, and confirmatory sampling after removal, with oversight by Westchester County Department of Health and New Rochelle Fire Department. After the conditions of the USTs were documented and the endpoint samples collected, the tanks were cleaned, sheared, and the steel recycled.</li> <li>• Non-time critical removal action (NTCRA) to address soils impacted with PCBs. We performed additional delineation (conducted in accordance with EPA Region 2 TSCA policy/requirements) and prepared an EE/CA, which included an alternative evaluation and proposed costs. Public review/comment was solicited on the NNTCRA recommendation, and a public meeting was held in New Rochelle. Subsequent to issuance of the Action Memorandum by USAC E, Tetra Tech performed the NTCRA excavation of the contaminated areas with verification sampling to ensure cleanup goals had been achieved.</li> </ul> <p>Performance Highlights included:</p> <ul style="list-style-type: none"> <li>• Successful and cooperative teamwork between Tetra Tech and local union staffing</li> <li>• Demolition of 94 asbestos-contaminated buildings, concrete structures, and related infrastructure</li> <li>• Beneficial use of processed concrete and brick from demolition to fill foundations to grade to realize cost savings</li> <li>• Achieved \$2 million budget savings due to innovative approaches</li> <li>• More than 150,000 man hours worked with no lost time and ZERO recordable incidents</li> </ul>
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**CLIENT: GEMS Landfill****GEMS Landfill Superfund Site PRP  
Camden County, NJ****PROJECT HIGHLIGHTS:**

- Groundwater extraction and treatment system design
- Construction quality assurance
- Design modifications for treatment of radionuclides
- Protection of threatened swamp pink plant species
- Groundwater monitoring
- Groundwater modeling
- Sediment investigation



Cornerstone personnel assisted the GEMS Landfill Superfund Site PRP Group, and subsequently the Trustees, with remedial design, remedial action, and operations at this Camden County, NJ site. The work included construction level design drawings and specifications for a groundwater extraction and treatment system, construction quality assurance (CQA), design modifications to address radionuclides, design modifications for a horizontal well, and performance monitoring.

Cornerstone developed a three-dimensional groundwater model and used it to evaluate the hydrogeologic characteristics of remedial options. The remedy selected was groundwater extraction using wells and an existing underdrain and treatment at the Camden County MUA (CCMUA) POTW. Cornerstone personnel designed the extraction and treatment systems and provided CQA during construction. Cornerstone personnel evaluated potential treatment options for naturally occurring radionuclides in the groundwater, including precipitation, ion exchange, and reverse osmosis, and assisted with evaluation of a pilot operation demonstrating that the existing treatment plant, with minor modification for sludge handling, would meet the regulatory pretreatment criteria.

Cornerstone personnel also assisted with modifications in the number and pumping rate of the extraction wells to address USEPA's concern regarding an adjacent threatened plant species (swamp pink). Through the use of a groundwater flow model, Cornerstone personnel demonstrated the impracticability of available options and that placing limits on the pumping rate would protect the swamp pink and meet the groundwater control requirements. Cornerstone more recently has assisted with an evaluation of sediment quality in an adjacent stream, further delineation of the down-gradient limits of the plume, and restoration of groundwater pumping capacity, lost because of fouling of vertical wells, through the installation of a horizontal well.

**CLIENT: Confidential Client****INDUSTRIAL PROJECT**

Elizabeth, NJ

**PROJECT HIGHLIGHTS:**

- Preparation of project documents including Remedial Investigation Report (RIR), Remedial Action Permits and Remedial Action Outcome (RAO)
- Delineation of VOCs and NAPL
- Design, bidding, and construction services for soil remediation in wetlands
- Long term performance and water quality monitoring
- LSRP Services

Cornerstone serves as technical consultant to a confidential industrial client for its former Facility site located in Rutherford, NJ. The facility was originally used for the manufacture and distribution of artificial orthopedic devices and medical instruments. Environmental investigations of soil and groundwater were triggered by ISRA during the sale of the property in 1998. The site is currently an active manufacturing facility.

For soil, a number of areas of concern (AOCs) were identified, both within and outside of the buildings. Some have received No Further Action letters (NFAs) from the NJDEP and others have been delineated by others. Cornerstone has been charged with completing the delineation of the remaining AOC in the adjacent wetland. This work is being done as a precursor to the proposed excavation and removal of a limited area of soils impacted by arsenic and cutting oils.

For groundwater, prior investigations have revealed the presence of chlorinated volatile organic compounds (CVOCs) in the parts per million (ppm) range beneath the building. Through the installation and sampling of several additional monitoring wells and the use of both manual and electronic groundwater level measurements, Cornerstone has defined the vertical limit of the plume and confirmed that the CVOCS are not migrating off site. As a result, it has recommended a monitored natural attenuation (MNA) remedy for site closure.

Cornerstone is currently providing LSRP services for the Site, working towards the issuance of an entire site Response Action Outcome (RAO) and the closure of the ISRA Case.

Specific services provided to date include:

- Development of a revised conceptual site model that correctly characterized groundwater flow.
- Development and negotiation of a remedial action work plan focusing on MNA.
- Research and delineate former floor drain system that likely played a role in CVOC discharges beneath the building.
- Pilot testing of an In-Situ Chemical Oxidation (ISCO) treatment through infiltration drains within the building.
- Develop and implement a long term monitoring including a groundwater classification exception area (CEA)

**CLIENT: Confidential Client****INDUSTRIAL PROJECT**

Elizabeth, NJ

**PROJECT HIGHLIGHTS:**

- Preparation of project documents including Remedial Investigation Report/Remedial Action Report (RIR/RAR)
- Delineation of VOCs in the bedrock groundwater
- Design, bidding, and construction services for soil remediation IRM
- Vapor Intrusion Investigation
- LSRP Services

Cornerstone serves as technical consultant and LSRP to confidential industrial client for a legacy ISRA site located in Elizabeth, NJ. The property has been the site of various industrial activities dating back to the 1920's. The former Facility Site has been the subject of various investigations associated with tank removals, spills, and historical property transfers that have occurred over the years. Many of the previously identified areas of concern (AOC) have been addressed and received no further action (NFA) letters from the NJDEP.

Cornerstone's LSRP has reviewed documents prepared by others over the years to close out AOCs previously remediated and issued NFAs. A number of other AOCs have been investigated, and an IRM performed to remediate soil contamination in a former drum storage area ahead of a planned construction project by the current owner of the facility. Cornerstone is currently investigating the horizontal and vertical extent of groundwater impacts associated with historic operations that have resulted in the presence of chlorinated volatile organic compounds (CVOCs) in the parts per million (ppm) range at the site.

A vapor intrusion investigation, including the performance of sub-slab and indoor air sampling has demonstrated that the VOCs impacting groundwater have not resulted in a vapor intrusion (VI) problem.

Cornerstone is currently providing LSRP services at the Site, working towards the issuance of an entire site Response Action Outcome (RAO) and the closure of the ISRA Case.

**CLIENT: Atlantic Resource Corp PRP Group****Superfund Site  
Sayreville, NJ****PROJECT HIGHLIGHTS:**

- Project work plan preparation
- Regulatory agency negotiations
- Construction quality assurance services
- Project certification

Cornerstone personnel provided engineering services for building decommissioning and demolition at the Atlantic Resource Corporation (ARC) Superfund Site, located on the south shore of the Raritan River in Sayreville, New Jersey. The ARC site had formerly been used for various industrial operations, including solvent reclamation, hazardous waste incineration, and precious metals recovery. Work included preparation of a detailed work plan, agency negotiations, construction quality assurance (CQA) services, and project certification.

The site consisted of three buildings attached by common walls, a fourth building, above and below ground storage tanks and vessels and various other equipment such as a bag house and hoppers and rotary kilns. The ARC site PRP Group entered into an administrative order on consent (AOC) to decommission and demolish the structures on-site as a removal action under CERCLA. Cornerstone personnel first assisted the group in negotiating the terms of the AOC to provide the flexibility for the group to implement the work in a practical and efficient manner.

Following execution of the AOC, Cornerstone personnel prepared a detailed work plan for building decommissioning and demolition. The work plan included a sampling and analysis plan, quality assurance/quality control (QA/QC) plan for demolition activities and analytical work, a recycling and disposal plan for management of demolition debris, a site security plan, a health and safety plan to establish the minimum health and safety requirements for work at the site, and technical specifications and bid documents governing contractor requirements for building demolition.

The plan was approved by the U.S. Environmental Protection Agency, and Cornerstone personnel assisted the Group with selection of a demolition contractor, provided field quality assurance services, and provided a certification that the work was performed in accordance with the approved work plan.

**CLIENT: Caldwell Trucking****Caldwell Trucking Site Trust**  
Fairfield, NJ**PROJECT HIGHLIGHTS:**

- Preparation of work plans
- Delineation of VOCs
- Evaluation of groundwater and surface water interaction
- Solute transport modeling

Cornerstone personnel provided groundwater services at the Caldwell Trucking Superfund Site, in Fairfield, New Jersey. The site had been a disposal site for septic sludge and also received a variety of volatile organic compounds (VOCs) including DNAPLs.

Work included conducting analysis to gain an understanding of groundwater/surface water interaction at a contaminated seep in a residential area, development of a site-wide numerical groundwater flow and transport model, development of capture zone remedial scenarios, and preparation of work plan documents for groundwater investigations. Cornerstone personnel conducted a pre-design investigation (PDI) for the groundwater remediation portion of the project and identified a shallow, highly fractured flow zone within the bedrock that had been overlooked by prior investigators. This zone was found to control both groundwater flow and contaminant transport processes at the site.

Based on this information, Cornerstone personnel constructed a groundwater flow model (MODFLOW) and contaminant transport model (MT3D) to define the horizontal and vertical components of flow. Of particular concern was a contaminated surface seep (pond) in a downgradient residential area and the potential for off-site sources. Due to extremely fast travel times in the fractured basalt bedrock, and the lack of matrix diffusion effects, the models predicted that there would be a relatively quick improvement in the quality of the seep discharge if the DNAPL source zone could be hydraulically contained. As a result, the design of the site's groundwater extraction and treatment system focused on the highly fractured flow zone.



**CLIENT: Confidential Client****Myers Property Superfund Site  
NJ****PROJECT HIGHLIGHTS:**

- Soil and bedrock NAPL investigation
- Monitoring, extraction and re-injection well installation
- Aquifer testing
- Engineering and design services
- Geophysical logging
- Feasibility study
- Environmental monitoring services, including groundwater, potable water, and treatment plant operation



Cornerstone personnel provided hydrogeological and remediation services to a confidential client at the Myers Property Superfund Site, a historic mill in New Jersey that was used to manufacture pesticides in the mid-1900s. Site work included a NAPL investigation, a hydrogeologic investigation for the design of an interim groundwater containment system, preparation of a bid package for demolition of the building and management of the demolition debris, preparation of a detailed engineering design package for the site's groundwater extraction and treatment system, construction assistance, and coordination of annual well sampling and water quality monitoring programs.

Cornerstone personnel performed an aquifer test to determine the properties of the highly permeable fractured rock aquifer and applied a groundwater flow model of the fractured rock aquifer to define groundwater flow directions in the anisotropic rock and to design the DNAPL zone groundwater containment system and groundwater reinjection system for treated groundwater. Using High Resolution Acoustical Televiewer (HRAT) logs, Cornerstone personnel confirmed the site conceptual model, explained why several key monitoring points were not responding to the interim groundwater extraction system, and recommended the location and depth for installation of additional extraction wells. Since the wells' installation and operation, the monitoring wells of interest have shown a steady decline in TVO concentrations.

Cornerstone personnel collected and analyzed building material samples to evaluate remediation and demolition/disposal options, assisted with the preparation of a bid package for demolition of the building and management of demolition debris, and provided assistance during implementation. Cornerstone staff also prepared a detailed engineering design package for bidding and construction of the groundwater extraction and treatment system, provided assistance during construction of the treatment plant and groundwater extraction and reinjection wells, certified that the work was completed in accordance with a USEPA approved design and now coordinates and implements an annual residential well sampling program within the vicinity of the site, as well as monthly treatment system performance monitoring and quarterly water quality monitoring.





## APPENDIX B: RESUMES

## EXPERIENCE SUMMARY

Mr. McGee has 30 years of experience in development of large science, engineering, and construction projects and serves as the National Program Lead for Tetra Tech's Contaminated Sediment Practice. This includes investigation and remediation of hazardous waste sites, and experience in sediment dredging, conveyance, dewatering, solidification, capping, and disposal. He has worked on several of the largest sediment projects in the nation performing the sediment sampling and logging, fluvial geomorphology, hydrodynamic modeling, and high resolution bathymetric surveys of the riverine systems and floodplains, design engineering of the material handling and process systems for sediment and waste water, and construction and O&M of the unit operations. He has performed mechanical and hydraulic dredging of contaminated sediments.

## RELEVANT EXPERIENCE

### Confidential Client, Comprehensive Risk Characterization Support for the Investigation and Clean-Up of a Former Explosives Manufacturing Facility, Eastern MA

Serves as National Contaminated Sediments Program Lead for this ongoing phased investigation at a large (250-acre) former explosives manufacturing facility in Massachusetts under the Massachusetts Contingency Plan (MCP) Program. The site was the location for the manufacture, testing and storage of a range of military and non-military explosives. The site constituents of concern are primarily **mercury**, lead, and TCE. Particularly challenging factors associated with the site are an adjacent river and ponds with elevated concentrations of the COCs, ongoing reuse activities, multiple property owners, and ongoing cost-sharing negotiations among the PRPs. Initial work has focused on evaluating the available site data and history; developing conceptual site models for the potential exposures at different areas at the site; identifying data gaps for purposes of risk characterization; developing soil, groundwater, surface water and **sediment** sampling plans; and gaining approval for the sampling plan with the MADEP and the public. Subsurface investigations in the soil and **sediment** also had to consider potential unexploded ordnance and ordnance explosive wastes. Performed the required MCP Phase II characterizations of risk to human health, the environment, safety and public welfare. Supported the development of RAOs for protectiveness and risk-based preliminary remediation goals.

### Lockheed Martin, Lockheed Middle River Complex Outfall 005 Sediment Removal Action, Middle River, MD

Responsible for the safe implementation for the time critical removal of 6200 in-situ cubic yards of TSCA regulated sediment located in Dark Head Cove in Middle River, MD. Participated in development of the project approach with the design team. Used a 40-ton crane barge and a 4 cubic yard environmental bucket fabricated by Cable Arm to mechanically dredge the sediment into hopper barges. Offloaded the sediment into articulating dump trucks staged on the upland for delivery into specially constructed sediment bins for processing to TSCA landfill specifications for strength. A mix recipe of Portland cement and quick lime was introduced using hydraulic excavators. Incidental contact water was collected, treated, and discharged to the POTW. Successful implementation required significant agency interface.

### Enbridge, Line 6B Project, MI

Served as Project Manager for the emergency response to address the release of crude oil into the Kalamazoo River in Marshall, Michigan. The release occurred on July 26, 2010 during a 25-year storm event which resulted in impacts to nearly 40 miles of the Kalamazoo River and floodplain. As Project Manager, Steve was responsible for many tasks including providing regular briefings to the Incident Command comprised of Enbridge leadership and members of many regulatory agencies including, USEPA Region 5, MDNRE, NOAA, USFWS, and local and county entities. Steve has assisted Enbridge in preparing for and participating in public meetings so that the information provided was audience appropriate. He has been integral in leading the Submerged Oil Task Force (SOTF) Working Group which was created to perform field assessment, characterization, and mapping of submerged oil impacts in surface water and **sediments** of Talmadge Creek, Kalamazoo River, and Morrow Lake. He guided the project through **the most efficient and cost-effective methods to conduct SOTF assessments** (qualitative

## EDUCATION

BS, Chemical Engineering, 1984

## AREAS OF EXPERTISE

Design, development, management of large-scale sediment remediation projects

Sediment dredging, conveyance, dewatering, solidification, capping, disposal

Federal/state regulatory knowledge

## RELEVANT TRAINING

DOT/HM-126F and 49 CFR 172, Subpart H Hazardous Materials Certified

HAZWOPER Hazardous Waste Operations and Emergency, OSHA

## PROFESSIONAL ACCOMPLISHMENTS

Recipient of 2001 Tyco Chairman's Award for Excellence in Service

Awarded "1991 Industrial Salesperson of the Year" from Rollins Environmental Services

Nominated by President EarthTech, Inc. for the Tyco Leaders for the 21st Century Program

## YEARS OF EXPERIENCE

30

and quantitative) through a carefully planned fluvial geomorphological, analytical chemistry, and sediment fate and transport modeling program. He and the project team worked with Enbridge to select the most **cost-effective, efficient technologies** for submerged oil removal from specialized dredging methods (including the Amphibex due to shallow depth of the Kalamazoo River) to flushing, aerating, and raking ecologically sensitive areas. The project team's work under Steve's leadership allowed the client to meet deadlines and **investigation/remedial requirements** set forth in EPA Orders.; the project is now transitioning from EPA to MDNRE oversight. Steve is currently assisting the client transition the project from emergency response to **investigation/risk assessment/remediation** in accordance with an MDNRE Order.

*If I don't connect with you next week, I wanted to extend my sincere thanks for all your dedication and focused attention to this project. I believe the level of effort and professionalism demonstrated by the TetraTech team allowed us to reach our goal ahead of schedule and brought the issue of submerged oil to the surface (pardon the pun)! Thanks again and please pass this on to those I may have missed or those who I have not had direct contact with. The field crews and the work they did on this was imperative to our success. They all did a superb job. – Karl F. Beaster, P.G., Environmental Analyst, Liquids Pipelines Environment*

*Steve - I regret having been unable to see everyone before I returned to Canada today. I did, however, want to thank you for your exemplary counsel and leadership as part of the Enbridge team.*

*You and your team are "top drawer" by any measure - expertise, professionalism, influence, integrity, judgement and results, among others.*

*I will gladly serve as a reference - you need not even ask me in advance. All the very best to you, – Byron Neiles, Enbridge Senior Executive President, Enbridge Wind*

#### **Enbridge Line 6B Project, Ceresco Dam Dredging & Dewatering Project, MI**

Project Manager responsible for the hydraulic dredging & conveyance, dewatering using geotextile tubes, and water treatment of all supernatant for **sediments impacted** by submerged oil located in a 6-acre footprint behind the Ceresco Dam. The fast-track design-build project was performed as part of the Enbridge Line 6B Project Emergency Response. Full time oversight was performed by USEPA Region V and Michigan DNRE. Innovative technique for removal of 1 foot of sediments in an area behind the dam with less than 3 feet of draft was required using the Amphibex machine. Approximately **20,000 tons of sediment** was dewatered in less than 30 days and passed the paint filter test without amendment addition required for landfill disposal. Presented project updates in public meetings with Enbridge Senior Management and USEPA Officials.

*In the presence of all the Enbridge executives, EPA Staff, and MDNRE State Officials, Mike Alexander, the Project Manager for Michigan stated, "In all my years of experience I have never witnessed a better managed project than Tetra Tech's Ceresco Dam Dredging Project."*

#### **Appleton Papers Inc., Georgia-Pacific Consumer Products LP, NCR Corporation, CBC Coatings, Inc. U.S. Paper Mills Corporation, Remedial Action of the Lower Fox River and Green Bay, Operable Units 2 through 5, Green Bay, WI**

Phase 2a Corporate Sponsor/Project Coordinator. Steve was mobilized to the site in March, 2008 to perform the design, construction, shakedown, and startup for the \$100 million Centralized Processing Facility. He demobilized in September, 2009. This design, construction, operation, and **remediation** project is contracted for \$700M over 10 years, one of the largest sediment remediation programs in the world. Over 2 million cubic yards of sediment have been hydraulically dredged, mechanically dewatered, and 45,000 trucks of filter cake transported to a licensed landfill for disposal. Successfully recovered, washed, and reused over 200,000 tons of sand on highway projects with the Wisconsin DOT that would have otherwise been disposed in the landfill at a high cost to the Owners. The project recently completed **1 million safe work hours**. Steve worked closely with several regulators and stakeholders, including EPA Region 5, the Wisconsin Department of Natural Resources, the Fox River Cleanup Group, and team subcontractors on seven different Working Groups. Over 28 major scientific and design deliverables were submitted to the agencies and approved in the first 14 months of the project. Achieved performance objective for a May 2009 facility start-up date with high accolades which satisfied a major milestone in the Administrative Order. Overcame the significant administrative challenge of procuring \$50M in equipment, with a lead time of one year for the eight plate-and-frame membrane filter presses and the 1,500 polyethylene filter plates manufactured in Europe. By working closely with vendors, we received over 120 Conex boxes of process equipment, delivered from Europe and staged in several warehouses in Green Bay, Wisconsin. Coordinated multi-disciplinary Tetra Tech project personnel for the 100% RD, RAC, RAO, and RC, including regulatory coordination liaison; design manager; health and safety manager and officers; QA/QC manager and officers; project engineers; site supervisors; dredging and capping manager; dewatering manager; and water treatment manager, along with teaming partners and subcontractors. Also utilized up to 300 union personnel during the construction of the Centralized Processing Facility. Managed innovative sediment infill sampling program approved by the regulatory agencies which resulted in a neatline engineering design as opposed to a prism design. This engineering design maximized the capture of target material, minimized the capture of non-target material, and reduced the sediment volume for dredging by 25% resulting in enormous saving for the Owner. Using cost and scheduling project controls, continuous forecasting and monitoring, and daily production meetings, completed the project on time and achieved all performance-based milestones. To achieve interim and final performance-based milestones, prepared a 1,600-activity critical path schedule in Primavera P3 for the fast-track design-build tasks and **sediment** dredging.

**Waste Management, Duwamish River Superfund Site, Seattle, WA**

As Engineering Design Project Manager, prepared the engineering design for the Waste Management–owned **sediment processing** Mixed Media Facility in Seattle, Washington with a capacity of over 3,000 cubic yards per day. Completed the mass balance and selected the equipment required to move the sediment from barges located at the bulkhead and into the rail cars for transportation for off-site disposal in a regulated landfill. The unit operations include the use of shaker screens, dewatering screens, radial hydrocyclones, thickeners, and centrifuges. The system requires a water treatment system that uses mixed media canisters, bag filters, and carbon filters.

**USAID, Da Nang Airport Dioxin Sediment Remediation, Vietnam**

QA/QC Officer responsible for the preparation of the Construction Quality Assurance Plan (CQAP) and the Quality Assurance Project Plan (QAPP) for the characterization, excavation and dredging, field progress performance monitoring and measurement, and confirmation sampling for the **dioxin-impacted soils and sediments**. Participated in the preparation of the project approach and estimate for the competitive bid required to obtain the award from USAID. The work is being performed under a \$20 million contract with USAID as part of the agency's environmental mission.

**BICC, Cables under-EPRI Building Sediment Remediation, NY**

Project Manager. The work is being performed as part of an \$80 million brownfields cleanup project at the former BICC Cables Project in Yonkers, NY. Owner's representative responsible for developing the approach and pricing for the removal of PCB-**impacted sediments** located under a 10-story building supported by H-Piles located in the Hudson River. Presented approach to NYSDEC on behalf of the Owner and obtained acceptance for the Pilot Study Work Plan to demonstrate the efficacy of the methods required for hydraulic dredging and conveyance, dewatering using geotextile tubes, and water treatment of all supernatant. Sediments shipped off-site in rail cars to a TSCA approved landfill.

**Waterfront Toronto, Full-Scale Pilot Demonstration for Sediment Treatment, Toronto**

Corporate Sponsor. Developed approach for the soil washing of ex situ material excavated and staged on the upland adjacent to Lake Ontario as part of the relocation of the Don River required for redevelopment of the Toronto waterfront. Soils were conditioned for soil washing by removing debris and slurried for wet hydrocyclonic processing for removal of coarse material. The coarse material was decontaminated using countercurrent washers and staged for reuse. Fines were thickened and dewatered with belt filter presses prior to disposal in a regulated landfill.

**The Dow Chemical Company, Hydrographic Survey of the Tittabawassee River, MI**

Corporate Sponsor responsible for the preparation and implementation of a high-resolution multibeam survey of a 22 mile reach of the Tittabawassee River. The work was performed to establish the baseline to document the mud line elevations in the river, and was also used to complete the geomorphic surface mapping necessary to select the sampling locations for the river investigation. This time sensitive project was implemented in the spring over 45 days during the snow melt to capture the data during high water when the river was bank full. Based upon the quality of the work Tetra Tech has done this survey for six consecutive years.

**EXPERIENCE SUMMARY**

Mr. Feeney is a Registered Professional Engineer with 40 years of experience in engineering design, construction and operations including hands-on management of several remedial investigation/feasibility study and remedial design/remedial action projects. Currently, he is assigned as the project engineering lead on the largest contaminated PCB sediment remediation project in the world in Green Bay, WI, involved with all aspects of facility design and serving as a key member of the operations and processing team onsite to ensure adherence to key quality parameters. Representative environmental project experience has included typical consulting assignments and the investigation, design, installation and construction/construction management of a wide variety of remediation systems and activities including site investigation and assessment tasks; environmental data collection and analysis; feasibility studies to identify and evaluate potential remedial solutions; treatability studies and bench scale testing; environmental construction permitting; contaminated sediment dredging, management, processing and transport and disposal; various civil/geotechnical techniques such as capping and slurry walls; contaminated sediment sampling and analysis; contaminated sediment engineered cap, sand cover and dredge design and installation; sediment processing system design, construction, start-up and operation; operation and maintenance of remedial or treatment systems; and coordination of project remedial design and remedial action plans with riparian property owners.

Mr. Feeney has managed remedial designs and actions at Superfund and other commercial sites in the northeastern, southeastern and central United States and is familiar with the various federal, state, and local regulations pertaining to hazardous waste cleanup activities. These include thermal treatment systems permitting, NPDES/SPDES and air permitting, RCRA; remediation activities such as the processing of contaminated media, sediment remediation by dredging or capping and operations and maintenance; and project demobilization and systems turnover.

Mr. Feeney has been responsible for management and constructability reviews for HTRW remediation projects in engineering, design, and construction from mobilization to turnover for contracts such as a large EPA Response Action Contract (RAC) Program in Region 2. Directed contractors and site managers, prepared reports and designs according to regulatory requirements, and obtained construction permits. Ensured QA/QC, completed site audits, and ensured safety and health and regulatory compliance. Mr. Feeney has conducted periodic reviews of Tetra Tech projects for compliance with corporate procedures, policies, and guides and reviewed engineering work being performed nationwide to determine that qualified engineers are performing the work, and peer reviews are being performed appropriately, for selected design/build efforts. Mr. Feeney then reviews engineering work on design/build projects so that it is being performed consistent with the overall project plan for procurement, construction work packages, etc.

**RELEVANT EXPERIENCE****Fox River Remediation, LLC, Lower Fox River OUs 2-5 Sediment Remediation, Green Bay, WI**

Assigned onsite as the Project Engineer on the largest PCB **sediment** remediation project in the world, valued at more than \$700 million. The work is being performed for a Responsible Parties (RPs) group under an Administrative Order. It involves extensive oversight by and coordination with a federal and state regulatory oversight team. The project centers on a 13.3-mile stretch of the Fox River beginning in the area of the Little Rapids Dam to the mouth of the river at Green Bay in which more than 500 acres of river bottom are being hydraulically dredged and an additional 566 acres are being capped. More than 4.6 million cubic yards

**EDUCATION**

MBA, Management, 1990  
MS, Mechanical Engineering, 1987  
BE, Mechanical Engineering, 1975

**AREAS OF EXPERTISE**

Construction management for RI/FS and RD/RA projects  
Contaminated sediment remedial design development and review  
Constructability reviews for HTRW remediation projects in engineering, design, and construction

**REGISTRATIONS/  
CERTIFICATIONS**

Professional Engineer, NJ  
#GE27083  
Professional Engineer, MI  
#6201032428  
Professional Engineer, SC #11196  
Construction Quality Management  
Certificate, US #LRE011500031  
Professional Engineer, WI #39792

**RELEVANT TRAINING**

Waste Management Employee  
Training, 40 CFR 265.16, 2011

**PUBLICATIONS &  
PRESENTATIONS**

Geevers, N., R.J. Feeney, T. Blackmar. Beneficial Reuse of Sand on the Fox River Sediment Remediation Project, presented at the PIANC Dredging Conference, San Diego, CA, Oct. 22-25, 2012  
R.J. Feeney. Overview and Coordination with Fox River Cleanup Project, presented at the 2015 Annual Port Symposium, Green Bay, WI, April 17, 2015  
The Largest Sediment Remediation Project in the World, presented at ASCE, WI Section, 2010 Spring Technical Conference, Green Bay, WI, March 11, 2010

**YEARS OF EXPERIENCE**

40

of **contaminated sediment** will be removed from the river, processed onsite, and transported and disposed of at either a TSCA risk based approved landfill for disposal of in situ TSCA materials or a non-TSCA landfill, as appropriate. Value engineering and adaptive management efforts are ongoing that have already saved, and will continue to save, the project millions of dollars and shorten the overall schedule.

The project is extremely high profile and involves extensive interaction with various consultants for the RPs, the oversight team and Tetra Tech's own subcontractors. As a result of the diligent effort by the Fox River Project engineering, procurement and construction team, processing facility design and construction prior to the start of remediation was completed within fourteen months in 2008/2009. Construction of the 6-acre building and enclosed large scale process systems took approximately nine months, allowing for a start of remediation earlier than required by the regulators.

The work involves the preparation of dredging and capping details, design plans to develop a 22-acre property for use as the principal staging and processing operations area, foundation design and technical specifications for a 250,000 sq ft pre-engineered building to house the processing systems, architectural and building systems design (plumbing, electrical, HVAC, fire protection) for the processing facility, design of dewatering and desanding systems (by a team subcontractor), which includes eight state of the art high-pressure membrane filter presses (each has 188 plates and weighs 586,000 lbs.), design of the 9,000-gpm water treatment system, design of the filter cake storage area with truck scales and truck wash facilities and administrative offices. Each filter press has a capacity of 600 cubic feet of filter cake. Remedial activities in the river began on April 28, 2009, and should be completed by approximately 2018 as the project is currently on schedule. During the initial year of remedial operations, the project exceeded its ambitious production goal by about 16%. In 2010 the project exceeded the impressive production level achieved in 2009 by an additional 33%. Through 2015 approximately 3.75 million cy of **contaminated sediment** have been dredged and processed representing more than three-quarters of the estimated total quantity for the project.

#### Program Technical Quality Control Manager

Responsible for all aspects of quality control on a large task order program involving pre-remedial, remedial investigation/feasibility study, remedial design, remedial action and operation & maintenance types of assignments. Delegated by the Program Manager with the responsibility and authority for the establishment of technical standards and procedures, implementation and maintenance of technical guidance documents and coordination of all reviews by appropriate scientific and/or engineering technical support disciplines. Ensured the appropriate incorporation of all client comments to plans, procedures, reports and/or other documents submitted to the client. Also provided input and technical support to the Program Manager and Project Managers on an as-needed basis.

#### U.S. Environmental Protection Agency, Region 2, Remedial Investigation/Feasibility Study, Little Valley NPL Site, NY

Managed a Remedial Investigation/Feasibility Study task order at the Little Valley, NY Superfund site. The predominant site contaminant was trichloroethylene (TCE) although detected concentrations were low, making a determination of the source area(s) difficult. Approximately 16 suspected source areas were studied. Soil gas sampling was employed at the outset as a screening tool in assessing potential source area locations. Simulprobe® sampling was utilized in locations where both soil and groundwater information was of interest. Subsequently, the project involved soil sampling, using hand auger and conventional rotary drilling/direct push methods, surface water and **sediment sampling** and groundwater sampling. Numerous new project wells were installed. The Project Manager assisted USEPA with obtaining property access for field activities. The remedial investigation included a Baseline Human Health Risk Assessment and an Ecological Risk Assessment. The feasibility study identified various potential remedial alternatives and evaluated their expected effectiveness, estimated costs and appropriateness as remedial solutions. Source area delineation, excavation, confirmation and off-site disposal was the remedy recommended for handling contaminated soil above the allowable level. The risk assessments concluded that use of the State cleanup standard for addressing the soil problem, although higher than the federal standard, would not result in any unacceptable risks. Therefore, the amount of soil requiring remediation in the feasibility study was reduced. Monitored natural attenuation (MNA) of the groundwater was evaluated and found to be an effective remedy for the plume. The client issued a new task order (see above) for the remedial action involving an ongoing MNA program at the site, including reporting on and interpreting the results as the groundwater plume was remediated.

#### Port Authority of NY/NJ, Call-In Contracts for Expert Professional Design and Consulting Services

The scope of these task order contracts included ecological studies and wetlands assessments, alternatives and cumulative impacts assessments, treatability studies, baseline assessments, compliance audits-site contaminant testing, assessments and remediation design, risk assessments, dredging, **sediment management** and material disposal and environmental and construction permitting. As Program Manager, Mr. Feeney participated in task order scoping and development, cost estimate and proposal preparation and supervised execution of the work by an appropriate task lead. Assignments included several environmental regulatory compliance audits, air quality permitting evaluation studies, health & safety inspections and the preparation of a comprehensive risk management plan pursuant to EPA requirements.

#### Agribusiness Technologies, Times Beach Remediation, Project, Times Beach, MO

At more than \$150 million, this project was one of the largest and most challenging design-build hazardous waste remediation assignments undertaken to date for a commercial client. Responsibilities included obtaining several permits (RCRA Part B and County Air Permit), devising and executing additional site delineation investigations, performing comprehensive design engineering services and managing all construction operations. The nature of the project involved construction of a ring levee

to protect the enclosed thermal treatment facility and staged hazardous materials from potential flooding, excavation and restoration of roadways at the site, which had been contaminated with dioxin, installation, testing and operation of a large-scale thermal treatment unit to process the contaminated soil and debris, water management and treatment responsibilities and final site restoration. In addition to remediating Times Beach itself, dioxin-contaminated materials from 25 other locations in Eastern Missouri, which collectively comprised the Superfund Site, were brought to Times Beach for treatment. More than 265,000 cubic yards of contaminated soils were eventually treated successfully. The former Times Beach project site is now a green space.

**New Jersey Department of Environmental Protection, Burnt Fly Bog Superfund Site Lagoon Stabilization and Environmental Protection Capping, Marlboro, NJ**

Responsible for the excavation of PCB- and lead-contaminated soils; stabilization of former lagoon sludges; and filling, grading, capping, and re-vegetation activities. The scope of services involved **construction engineering** and required administration of the construction and disposal contractor for the NJDEP and provision of site management, Health and Safety, Quality Assurance/Quality Control, and other services, via a field staff. Managed the \$1.5 million HTRW remediation. Directed staff of six during the remediation; managed the onsite field chemists collecting and analyzing 30 samples per day. Data were used to verify soil cleanup standards achievement prior to backfill.



## EXPERIENCE SUMMARY

Mr. Henn has more than 23 years of experience conducting environmental investigations, sediment investigations, remediation and energy management. He is the Director of Remediation and Energy for Tetra Tech, Inc. and Vice President of Bioenergy. Mr. Henn has been a project manager and/or technical lead on numerous projects having values up to \$50M and on programs up to \$500M.

Mr. Henn's site assessment and remediation experience includes management and treatment of petroleum and chlorinated VOCs, SVOCs, metals, PCBs, dioxins, herbicides and pesticides, explosives/energetics, perchlorate, fuel oxygenates, and emerging contaminants (e.g., 1,4-dioxane, PFC/PFOAs). Core competencies within these areas include investigation, natural attenuation, and geochemistry evaluations, all types of in situ remediation, and state of the art remediation technology evaluation and implementation. Mr. Henn has implemented or participated in over 100 in situ treatability studies and full scale design and implementations involving bioremediation, biogeochemical, chemical reduction/oxidation, thermal treatment, and phytoremediation for these contaminants. He has achieved regulatory no further action (NFA) on several sites. Mr. Henn is recognized as an expert in the use of bioremediation, nanoscale zero valent iron and other forms of in situ remediation.

Mr. Henn is also the Director of the Remediation Strategies Team, a network of remediation experts that collaborate and foster tech transfer across the more than 16,000 employees of Tetra Tech.

## RELEVANT EXPERIENCE

### INVESTIGATION & REMEDIATION EXPERIENCE

**Project Manager; Environmental Management; Lyondell Environmental Custodial Trust** Conducted Site and Environmental Management consulting services at the Former Lyondell Beaver Valley site in Potter Township, PA. This work includes performing routine site checks, inspections and reports; site maintenance of soil cover/cap areas; groundwater, surface water, and sediment sampling regulatory agency interface. The site has been estimated to have up to several million pounds of VOC including LNAPL.

**Project Manager, Remediation for Aircraft Components Manufacturer, Cleveland, Ohio.** Mr. Henn was the project manager of a multi-area remediation project for a confidential defense client. Mr. Henn was responsible for developing and implementing project scope, budgets, and schedule and for communicating with the client's and current site owner's legal and project management teams. This project involved multiple soil source areas that have been remediated under Ohio VAP and Ohio BUSTR programs. Groundwater impacted by CVOCs, petroleum hydrocarbons, mercury, and metals contained by a pump and treatment system. This remedial approach is currently being optimized including refinement of the current system as well as evaluation of alternative approaches.

### EDUCATION

M.S., Hydrogeology, Wright State University, 1996

B.S., Geology, University of Pittsburgh at Johnstown, 1993

### REGISTRATIONS/ CERTIFICATIONS

Professional Geologist, PA, #PG-003767-E, 2000

Professional Geologist, TX, #5451, 2003

Professional Geologist, AL, #1237, 2009

Professional Geologist, IL, #196-001091, 2003

Professional Geologist, SC, #2242, 2000

Professional Geologist, FL, #PG-0002133, 2000

### TRAINING/CERTIFICATIONS

OSHA 1910.120 40-Hour HAZWOPER Training

OSHA 1910.120 8-Hour Annual Refresher Training & Supervisory Training; annual

Ohio Voluntary Action Program Certified Professional Initial Training

### OFFICE

Pittsburgh, Pennsylvania

### YEARS OF EXPERIENCE

23

### YEARS WITHIN FIRM

19

### CONTACT INFORMATION

Keith Henn  
412.921.8398  
keith.henn@tetrattech.com



**Project Manager/Project Hydrogeologist; Site Characterization, NOVA Chemicals, Inc.; Ohio and Illinois.** Prepared the proposal, work plan, and final reports to evaluate the presence of contamination at chemical facilities. Responsibilities included developing and meeting the schedule, scope, and budget, and formulation of project objectives, sampling design, rationale, and approach. Mr. Henn prepared multiple site specific work plans, master work plan, and quality assurance project plan for six sites (these two sites, 2 other domestic sites, and 2 European sites). BJ Stephan (client) wrote that, “Belpre is very pleased with how the project has been run, excellent job... (it) was the most efficient and best run external job that they have ever had.” Upon completion of the project, Brigitte Goudreau (fmr client manager) wrote if “I ever need remediation work, you (Keith) will be the first person I call”.

**Groundwater Modeling Specialist; EWAN Property Site, OU 2; Shamong Township, NJ; Remedial Design Modeling.** Created and utilized MODFLOW and MODPATH models to optimize the pumping rates of seven extraction wells to achieve hydraulic control and re-injection of the treated effluent water into surrounding wetlands.

**Technical Expert and Hydrogeologist; Beazer East, Inc., Cabot Carbon/Koppers Superfund Site, Gainesville, FL** Provided technical expert support on the site characterization, large diameter In situ Solidification and Stabilization (ISS) pilot implementation, and evaluation of the performance of a pump-and-treat system for 13 extraction wells to ensure the capture of groundwater contaminants (BTEX, chromium, arsenic, and naphthalene) on site.

**Groundwater Modeling Specialist; Industrial Client; Long Branch, NJ; Modeling for Litigation Support.** Created and implemented a groundwater flow and contaminant transport model for litigation support. Favorable results supported the client's defense.

**Remediation Specialist; In Situ Anaerobic Remediation and Remediation Planning; Industrial Client, Maryland.** Prepared remedial goals, remediation plan, and designed/implemented 3 pilot-scale studies for comparison and selection of remedial technologies for full scale implementation. The pilot scale technologies included (1) nanoscale zero valent iron (ZVI) injection; (2) sodium lactate injection coupled with bioaugmentation; and, (3) emulsified soy-based oil coupled with bioaugmentation. This study is one of the first where aquifer buffering was performed in combination with bioaugmentation. Results of the pilot studies demonstrated up to 92% reductions (from starting concentrations of up to 33 mg/L TCE and 120 mg/L DCE) coupled with an increase of up to 40 times innocuous byproducts (e.g., ethane and ethane). Modifications to the original remedial approach are being evaluated to address 1,4-dioxane (up to 1.2 mg/L) recently discovered in the subsurface. Remedial goals for full scale remediation (up to \$16.7 million) were prepared and presented to the Head of Remediation of this Fortune 100 client.

**Remediation Specialist; Remediation Planning; Industrial Client, Maryland.** Remedial goals for full scale remediation and associated implementation costs (up to \$14.9 million) were prepared and presented to the client for remediation requiring clean closure for Brownfield redevelopment. The technical approach and costs were verified by two third party reviewers. Results of the remedial investigation data suggesting CVOs (up to 5 ppm), BTEX (up to 0.5 mg/L), and 1,4-dioxane (up to 0.12 mg/L) are present at the low permeability site. In situ bioremediation, ZVI, chemical oxidation, and ex situ treatment were evaluated and are currently being written in a site Remedial Action Plan.

**Remediation Specialist; MNA at Numerous Industrial Sites.** Performed evaluations or peer-reviews of natural attenuation studies at over seventy-five different sites. Sites included contamination including petroleum hydrocarbons (e.g., BTEX, PAHs), fuel oxygenates (MTBE), chlorinated solvents (e.g., PCE, TCE, TCA, etc.), explosives (e.g. TNT, RDX, HMX, etc.), perchlorate, metals, and other contaminants. Many evaluations included analytical models such as Bioscreen and Natural Attenuation Software (NAS) have been utilized successfully. In addition to the collection of conventional MNA and geochemistry analysis, advanced geochemistry (e.g., bio-available iron), advanced microbial (e.g., *Dhc* and target gene detection using RTm qPCR, DGGE, and PLFA) and isotopic (e.g, compound specific isotopic) analyses has been utilized.

**Continuous Optimization Program, Infrastructure Audit and Data Accessibility Report, Nevada Environmental Response Trust (NERT) Site Henderson, Nevada.** Mr. Henn led a team to prepare the Infrastructure Audit and Data Accessibility Report for the Pump and Treat system named the Groundwater Extraction

and Treatment System (GWETS) to treat hexavalent chrome, and perchlorate. The work included well field equipment, lift station pumps, effluent pump station, and pipeline assessment, It also evaluated the groundwater treatment and fluidized bed reactor (FBR) treatment plants.

**Remediation Specialist; FS for Chromium Remediation; Former J&S Chrome Site, California.** Managed and spearheaded the selection of remedial technologies. The maximum concentration of chromium VI in subsurface soil is 200 mg/kg (to 80 feet bgs) and in groundwater is 166,000 µg/L (shallow aquifer). Report was prepared under an accelerated schedule and was prepared on time and under budget. The remedy selected included a permeable reactive barrier (PRB) using zero valent iron (ZVI) to reduce chromium in the groundwater to chromium III, and subsequently precipitate the chromium III, as it passes through the barrier. The barrier would be installed via directional fracturing from a depth of 65 to 102 feet bgs.

**Remediation Specialist; Remediation Planning; Industrial Client, California.** Mr. Henn was involved in the remedial alternatives analysis and bench scale test planning for perchlorate concentrations in groundwater exceeding 900 ug/L. In situ and ex situ remedial methodologies were evaluated with enhanced in situ bioremediation selected as the preferred remedial technology. Bench scale testing was evaluated as part of this evaluation. Remedial implementation options included aqueous carbon injection via injection wells and mulch biowalls installed using a one pass trencher.

**Project Manager/ Remediation Technical Expert; Site Investigation; Feasibility Study, Vapor Intrusion Evaluation, Proposed Plan, Record of Decision, Anniston Army Depot (ANAD); U.S. Army; Anniston, Alabama.** Spearheaded the proposal, orals presentation and project management to perform a FS, VI Assessment, Proposed Plan, and Record of Decision. The FS includes completion of tasks involving mass flux assessments, pump and treat optimization, development of treatment trains, and natural attenuation assessment (biological, biogeochemical, and chemical reduction/oxidation), modeling, et al., for 4 source areas having multiple releases. The site has been estimated to have up to 27 million pounds of CVOC DNAPL, residual and aqueous contaminants in weathered, fractured and karst bedrock. The FS evaluates numerous innovative technologies where a Technical Impracticability (TI) proposal by a previous contractor was dismissed by EPA and ADEM. Alternatives were developed for timeframes including 100 years, 500 years, and 1,000 years to cleanup to regulatory standards.

**Lead Program Hydrogeologist, Department of the Navy.** Mr. Henn was responsible for maintaining technical standards for all aspects of geology/hydrogeology, site investigation planning and practices (e.g., monitoring well installation, data quality objectives, groundwater modeling, etc), and remediation design and implementation for the program. In this role, Mr. Henn participates in more than 500 contract task orders and ensures that all of the projects follow and comply with the defined intra-company, client, and regulatory technical standards and policies. Mr. Henn develops and coordinates the implementation of technical guidelines related to all geology/hydrogeology and natural attenuation related aspects of the contract. Mr. Henn is responsible for developing, implementing and distributing information on innovative and cost-saving methodologies and strategies. Some of the investigative technologies implemented include the use of Membrane Interface Probe (MIP), passive diffusion bag (PDB) and HydraSleeve™ groundwater samplers, borehole flowmeters (heat-pulse and colloidal borescope), prepacked micro-wells, and multi-channel wells. Some of the remediation approaches include selection and implementation of conventional bioremediation [(Oxygen and Hydrogen Releasing Compound<sup>®</sup> (ORC/HRC), emulsified oils, lactate], alternative bioremediation approaches {e.g., alternative substrate [chit-in, direct oxygen, hydrogen and propane gas delivery using the in situ Submerged Oxygen Curtain (iSOC™)]}, cometabolism, biosparging, amendment delivery mechanisms (e.g., hydraulic/pneumatic fracturing), abiotic destruction/adsorption of contaminants (e.g., permeable reactive/adsorptive wall technologies and micro/nanoscale iron particle injection), chemical, thermal destruction technologies (e.g., electrical resistive and conductive heating), and phytoremediation.

**Co-Principle Investigator/Project Manager; Application of Nucleic Acid-Based Tools; DoD Environmental Security Technology Certification Program (ESTCP); Project # CU-0518; 2005 to 2010.** Mr. Henn co-prepared the proposal, demo plan and implementation of a comprehensive nucleic acid-based (i.e., bio-marker) toolkit which evaluates and assesses dechlorinating bacteria [*Dehalococcoides (Dhc)*] and specific target genes such as *tceA*,

*bvcA*, and *vcrA*] testing in field applications. This unique demonstration and validation (Dem/Val) project applies the results to support sites where MNA is being evaluated; predict sites where biostimulation will be successful; and identify sites where bioaugmentation is required. This is the first Navy Environmental Broad Agency Announcement (BAA) proposal granted to Tetra Tech, Inc.

#### EXPERIENCE SUMMARY

Ms. Blackmar has over 30 years of experience as a geological/environmental/ civil engineer. Her responsibilities have covered construction management/CQA and geotechnical evaluations for construction; RCRA/CERCLA/TSCA remediation and compliance; site investigations for contamination and for landfill siting (characterization); remedial investigation/feasibility studies and treatability studies; solid and hazardous waste landfill permitting and design, and construction quality assurance; remedial design and remediation oversight for a variety of remediation projects; sediment remediation, including design and specification of dewatering systems, remedial design in waterways, and construction oversight during remediation; RCRA facility closures, including building demolition oversight; and expert witness and litigation support for several projects. She is a Tetra Tech Vice President for the Great Lakes Operations.

#### RELEVANT EXPERIENCE

##### Fox River Sediment Remediation Project, Green Bay, WI

Senior Design Engineer responsible for leading Tt's design effort for the remedial work in the Lower Fox River, a **sediment mega-site** and the largest PCB removal project in the world with an estimated cost of approximately \$700 million. Also responsible for development of Technical Memoranda on the process design basis for the **sediment desanding and dewatering** Plant; break-even points for dredging versus capping; designs for difficult areas; temporary RCM cover; dolomite pilot test; development of estimates for SWAC and PCB mass removal; alternative contamination surface modeling; and various other design-related subjects. Prepared and updated the mass balance calculations to provide production estimates for filter cake and separated sand based on dredging rate. Prepared the annual Remedial Action Work Plan for each dredge season, and assisted with the preparation and updating of other technical documents such as the CQAPP and QAPP. Designated as the Phase 2B Project Coordinator in 2009 and continues to serve in that role. Oversaw design efforts for a sheet pile bulkhead wall to be constructed along the banks of the Fox River and provided recommendations for a change in layout to reduce cost. Developed Value Engineering Plan for cost saving strategies for the project. Provides assistance with discussions held with riparian landowners and developed a Technical Memorandum to describe the notification process for this activity. This project was named Midwest Project of the Year by Engineering News Record in 2009.

##### Confidential Client, Sediment Removal and Capping, Village Harbor, MI

Lead design effort for design of underwater capping systems proposed for **impacted sediment** in a harbor located on Lake Michigan. Supervised staff in the development of Remedial Action Work Plans for addressing the sediments and mitigating elevated pH resulting from the sediment. Performed slope stability calculations on a portion of cap located on a submerged slope.

##### ENTRIX/Northwestern Energy, Sediment Remediation, Moccasin Creek, Aberdeen, SD

Certifying engineer for this \$2.5M **sediment remediation** project in Aberdeen, South Dakota, which was successfully designed, bid, and completed in 2007. Key design elements included sheet pile design, creek and culvert flow bypass systems, water treatment system design, and site development design. Assisted the client with construction management issues during remediation and implemented a material recycling program that resulted in project savings. The project was completed on time and under budget.

#### EDUCATION

BS, Geological Engineering, 1985

#### AREAS OF EXPERTISE

Certifying engineer for sediment remediation projects

Civil and geotechnical engineering

Evaluation of remedial strategy cost effectiveness

Construction oversight for remediation projects

#### REGISTRATIONS/ CERTIFICATIONS

Professional Engineer, Civil, IN

Professional Engineer, Civil, IL

Professional Engineer, Civil, LA

Professional Engineer, Environmental, LA

Professional Engineer, Civil, MS

Professional Engineer, Civil, MI

Professional Engineer, Civil, WI

#### PUBLICATIONS & PRESENTATIONS

Blackmar, T., R. Menozzi, G. Green, T. Binsfield, V. Buhr, S. McGee, C. Moses, and S. LaViolette. 2003. Grand Calumet River Sediment Remediation Project: Largest Impacted Sediment, Hydraulically Dredged Project in North America. Proceedings of the Western Dredging Association 23rd Technical Conference & 35th Texas A&M Dredging Seminar. June 2003

Blackmar, T.L., J. Trast, and D. Pierce. Bulkhead Design Incorporating Beneficial Reuse of a Sediment for a Material Staging Facility. Fifth International Conference on Remediation of Contaminated Sediments. February 2009

#### YEARS OF EXPERIENCE

30

**U.S. Steel Corp., Grand Calumet River Sediment Remediation Project, Gary Works, Gary, IN**

Lead design engineer for this \$50M river dredging and contaminated **sediment remediation** project. Responsible (certifying engineer) for redesign of the Corrective Action Management Unit (CAMU), a passive dewatering and sediment containment system with a TSCA-permitted unit for PCB disposal, designed to meet RCRA Subtitle C landfill design standards, for disposal of PCBs, PAHs, and other contaminants. Through value engineering on the redesign, achieved approximately \$2M in construction cost savings for the CAMU. Developed the Construction/Operation Level Design Report (COLDR), responded to EPA comments, and received EPA approval for the redesign within six months following the initial submittal. Reviewed cover design by others, and suggested design revisions that resulted in another \$4.5M in savings.

**Kane County Public Building Commission, Sediment Remediation, Roof Replacement, and Construction Management, Kane County Judicial Center, IL**

Project Manager for this \$5.2M award-winning (ACEC) project that included investigation of lead and copper contamination resulting from roofing panels installed on the Court House at the Judicial Center site. Completed site investigation of a nine-acre retention pond and sampling of roof runoff and evaluated findings under the Illinois Tiered Approach to Corrective Action Objectives (TACO). Developed Site Investigation/Remedial Objectives Report and Remedial Action Plan for remediation of **lead-contaminated sediment** in the pond and associated drainage structures (on and off-site). Enrolled the site in the Illinois Site Remediation Program (SRP). Evaluated remedial alternatives, including dredging and non-dredging alternatives. This project also included oversight of roof demolition, evidence sampling, an air monitoring program, verification sampling plans, and coordination with subcontractors. Developed design drawings and specifications for pond remediation work. Managed the bid process. Received draft NFR letter from IEPA within two weeks of submittal of the Remedial Action Completion Report. Completed project on schedule and for under \$5M.

**Gary Sanitary District, Preliminary Screening and Limited Waste Treatability Study for PCB-Impacted Sediment, Gary, IN**

Performed a limited treatability study and screened remedial alternatives for remediation of **PCB-contaminated sediment** contained in an 18-acre Lagoon. Prepared a report on the study and presented remedial alternatives, along with relevant cost information, to assist client in determining the most cost-effective remediation alternatives.

**Louisiana Power & Light Company, Sludge/Sediment Investigation and Remediation, Treatability and Feasibility Studies, Impoundment Permitting, Multiple Sites, LA**

Project manager for surface impoundment upgrade and closure activities associated with eighteen existing impoundments at five plants. Prepared permit applications for four of the existing impoundments. Performed site investigation of each impoundment, including **sediment sampling** and thickness measurement. Performed bench-scale treatability testing and feasibility studies for each site, to determine the most cost-effective remediation. Prepared closure plans, specifications, and bid documents for 14 impoundments, including dewatering and sediment/sludge solidification. Supervised field monitoring activities and prepared certification documents for pond closure activities.

**CIBA-Geigy Corp., Multiple Soil Remediation Projects and Design and Monitoring of a Biological Treatment Unit, St. Gabriel, LA**

Project manager for several projects involving the remediation of soils impacted with petroleum hydrocarbons (benzene, toluene) and herbicides (5-CAT). Monitored excavation and prepared hazardous waste manifests. Designed and monitored construction of a biological treatment unit that was used to treat some on-site contaminated soils. Performed sampling and analysis of treated soils to monitor effectiveness, and developed a certification report documenting the soil treatment to pre-approved levels and closure of the unit.

### EXPERIENCE SUMMARY

Mr. Braun is the Western Director for the sediment management program at Tetra Tech. He is a biological oceanographer with environmental remediation experience in both marine and freshwater settings. He has served as project manager or task lead for remedial investigations/feasibility studies (RI/FS), and remedial design and construction for cleanup of contaminated sediments at numerous federal (CERCLA) Superfund and state sites. This experience has provided him with a broad practical perspective, critical to identifying and evaluating the feasibility of alternative remedial strategies and associated technologies. Mr. Braun has played a key role in strategic planning with project stakeholders and coordination and negotiations with regulatory agencies in development of cleanup action plans, permitting, NRDA strategies, and project implementation. Mr. Braun has extensive experience in all phases of impact assessment, specializing in the analysis of contaminated sediments and interpretation of benthic community data, especially in relation to sediment contamination. In addition, he has extensive experience applying CERCLA, NPDES, federal and state sediment criteria to the characterization and remediation of contaminated sediments, and is experienced with the ecological and human health risk issues as they apply to contaminated sediment sites. During the past 30 years, he has performed numerous studies and assessments of impacts from point (i.e., NPDES permitted) and nonpoint source pollutants in marine, estuarine, and freshwater systems. Many of these assessments have been for the purpose of determining compliance with federal or state regulations. Experienced in the field and laboratory quality assurance/quality control procedures that are essential for the collection of high quality data. He is highly familiar with marine and estuarine ecology, and experienced using univariate and multivariate statistical techniques, essential for elucidating ecological relationships and assessing the effects of pollutant stresses on the biota.

### RELEVANT EXPERIENCE

#### Lockheed Martin, Lockheed Middle River Complex Sediment Site Feasibility Study, Middle River, MD

Tetra Tech is providing Remedial Investigation/Feasibility Study (RI/FS) services to Lockheed Martin Corporation for the Lockheed Martin Middle River Complex Site located in Middle River, MD. The purpose is to (a) to determine the nature and extent of contamination and any threat to the public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants or contaminants at or from the Site, by conducting an RI; and (b) to identify and evaluate remedial alternatives to prevent, mitigate, or otherwise respond to or remedy any release or threatened release of hazardous substances, pollutants, or contaminants at or from the Site, by conducting a Feasibility Study (FS). As the FS lead, worked closely with the client and regulatory agencies (e.g., EPA) to develop expedited and streamlined remedial strategies for the site, and oversaw the preparation of the FS. Conducted the FS evaluations by developing preliminary remediation goals, screening remedial technologies, developing remedial alternatives, and evaluating and identifying a preferred remedial alternative.

#### Appleton Papers Inc., Fox River Sediment Remediation, WI

Oversees all science-related activities for the nation's largest dredging and remediation project. Field activities have included **sampling of the river sediment** using check valve samplers, piston core samplers, and sonic drill rigs on floating platforms, as well as conducting a detailed pilot scale bench test to evaluate filter cloth options for the filter presses to be installed in the treatment facility. Supervises the field team performing QC checks and ensures technical

### EDUCATION

MS, Biological Oceanography, 1986  
BA, Biology & Geology, 1981

### AREAS OF EXPERTISE

Contaminated sediment program development and implementation  
CERCLA, NPDES, federal and state sediment criteria  
Leading teams for multi-million dollar contaminated sediment investigations nationwide

### RELEVANT TRAINING

40-Hour OSHA Hazardous Waste Health and Safety Training, 1997  
8-Hour OSHA Hazardous Waste Health and Safety Refresher Course, Current  
DOT Employee Training Program, DOT/HM-126F HAZMAT Training 49 CFR 172, Subpart H  
CPR/First Aid/AED, current

### PROFESSIONAL AFFILIATIONS

Member, Western Dredging Association  
Member, Sediment Management Work Group  
Member, Society of Environmental Toxicology and Chemistry, national and Northwest Pacific Chapter

### PUBLICATIONS & PRESENTATIONS

Predicting Sediment Reactive Cap Design Life: A Case Study. Paper presented at the Sediment Management Work Group Fall Sponsor Forum and Site Tour, Syracuse NY, October 1-3, 2013. Craigie, K., & G. Braun.  
McGee, S., G. Braun, C. Patmont, G. Berken, and J. Lawson. 2011. Evaluation of Sediment Residuals in OU3 of the Fox River Sediment Remediation Project. Platform presentation, 6th International Conference on Remediation of Contaminated Sediments, 2011

### YEARS OF EXPERIENCE

30

accuracy and completeness of the work. He also works directly with the client and regulators presenting findings and negotiating approaches.

**Gulf of Thailand, CTEP Sediment Management Project; *State of the Art in Deepwater Dredging and Capping***

Lead research scientist for evaluation of sediment mercury remediation case studies, development of a remediation summary report, and investigation and recommendation of special studies to support the evaluation of sediment mercury remediation technologies. The project focus is state of the art deepwater dredging and capping technology, pilot studies, and sediment remediation projects world-wide. Research includes analysis of findings as relevant to a confidential overseas sediment mercury remediation project, feasibility study, technology implementation, and design.

**Lockheed Martin, Lockheed West Seattle Superfund Site Remedial Investigation/Feasibility Study, Seattle, WA**

Project Manager for this sediment remediation project for which Tetra Tech is providing Remedial Investigation/Feasibility Study (RI/FS) services to Lockheed Martin Corporation for the Lockheed West Seattle Superfund Site located in Elliot Bay, Seattle. The purpose is to (a) to determine the nature and extent of contamination and any threat to the public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants or contaminants at or from the Site by conducting an RI; and (b) to identify and evaluate remedial alternatives to prevent, mitigate, or otherwise respond to or remedy any release or threatened release of hazardous substances, pollutants, or contaminants at or from the Site, by conducting a FS. As the project manager, worked closely with the client and regulatory agencies (e.g., EPA) to **develop expedited and streamlined remedial strategies** for the site, oversaw the preparation of RI/FS work plans (including sampling plan and quality assurance plan) for the Remedial Investigation. Conducted the RI field effort by coordinating project team and subconsultants for the collection of surface sediment and core samples, intertidal samples, habitat survey, high-resolution multibeam bathymetric survey of the project site. Conducting ecological and human health risk assessments, remedial investigation evaluations of nature and extent, developing preliminary remediation goals, and assessing potential remedial alternatives.

**Multiple Clients, Former Munitions and Pyrotechnics Manufacturing Site, Groundwater, Soil and Sediment Remediation, Hanover, MA**

Sediment design project manager for a 240-acre site in southeastern Massachusetts that has extensive sediment and soil contamination, some areas with impacted groundwater and potential unexploded ordnance and ordnance explosive waste (UXO/OEW). Lead, mercury, and organic solvents, were used in historical Site manufacturing operations. Sediment remedial design in the 50 acres of wetlands and ponds onsite includes dredging, sediment capping and enhanced natural recovery (thin capping) to reduce human health and ecological risks associated with mercury and methyl mercury while minimizing disturbance of wetlands, dense existing foliage and designated conservation areas.

**PacifiCorp Remedial Action Company (PERCO) and Puget Sound Energy, Remedial Design, Head of Thea Foss Waterway, Tacoma, WA**

Project Manager for all tasks related to the remedial design/remedial action for the contaminated sediments located at the head of the Thea Foss Waterway. Thea Foss Waterway is part of the Commencement Bay Nearshore/ Tideflats Superfund area. EPA issued a ROD and ESD that specifies the cleanup plans and performance criteria for the remedial actions. Our clients submitted a "good faith offer" to the local regulators to remediate the head of the waterway. The head of the waterway is unique in that there are NAPL seeps in the sediments which require a unique remedial design to control them. The selected remedial action includes the placement of an isolation cap throughout the head of the waterway. Project tasks include assisting client with Consent Decree and SOW negotiations with EPA, collection and evaluation of elutriate and geotechnical data in support of cap design and dredge material disposal, contaminant mobility evaluation of the required thickness of a sand cap to provide long-term protection to the aquatic environment, design of unique cap to control and contain a NAPL seep located within the waterway, and overall design (30%, 90%, and 100%) of the remedy. The selected remedial action includes the placement of an isolation cap throughout the head of the waterway. Also responsible for providing design support during completion of the remedial action, which consisted of five major components, including dredging; construction of a sheet pile retaining wall; design, construction, and installation of a unique impermeable cap to control a NAPL seep; erosion protection in front of two large outfalls; and general capping of soft sediments throughout the Head of the Thea Foss Waterway. During the construction, scope of work also included the necessary field engineering, contract management, construction QA/QC, and monitoring support services.

**Enbridge, Crude Oil Release Project, Marshall, MI**

Served as senior scientist for this nearly 800,000-gallon crude oil release project in Marshall, Michigan. The release occurred on July 26, 2010 and, due to a 25-year storm event occurring shortly thereafter, contaminated nearly 40 miles of shoreline of the Kalamazoo River and impacted several private residential properties. As a senior scientist, has assisted the project team in preparing addendums to regulator-prepared work plans, drafting work plans and technical reports, and providing senior technical review of technical documents. Supported the Project Manager in preparing meeting materials and briefings for the Incident Command Meetings that were attended by the client and members of many regulatory agencies including, USEPA Region 5, MDNRE, NOAA, USFWS, and local and county entities and the Submerged Oil Task Force (SOTF) (includes client, EPA, MDNRE, and other contractors), which was created to perform field assessment, characterization, and mapping of submerged oil impacts in surface water and sediments of Talmadge Creek, Kalamazoo River, and Morrow Lake. The project team's work



allowed the client to meet deadlines and investigation/remedial requirements set forth in EPA orders. The project is now transitioning from EPA to MDNRE oversight and from emergency response to investigation/risk assessment/remediation in accordance with an MDNRE order.

**U.S. Fish and Wildlife Service, Evaluation of Restoration Alternatives (Phase III), West Branch Grand Calumet River, Gary, IN**

Assisting the client to address various aspects of the management of contaminated sediments in the channel and habitat restoration along the West Branch of the Grand Calumet River (WBGCR) system in northern Indiana. The Grand Calumet River is a low-gradient waterway in the industrialized areas of northwest Indiana and northeast Illinois. Tetra Tech is providing the U.S. Fish & Wildlife Service with a technical approach for preparing a comprehensive, technically sound, and regulatory-defensible restoration alternative development and evaluation for the WBGCR. The report will be used in completing the Restoration and Compensation Determination Plan (RCDP) component of the natural resource damage assessment (NRDA). The goal is to develop and evaluate alternatives in a manner that conforms with criteria developed in the RCDP. The project tasks includes conducting a Baseline Human Health Risk Assessment, developing Remedial Action Objectives and preliminary remediation goals based on ecological and human health risks, and developing and evaluating restoration alternatives for the WBGCR. A variety of technologies are being evaluated to remediate contaminated sediments. These technologies include natural recovery, dredging, in-place capping, sediment disposal, and sediment treatment. The advantages and disadvantages of these technologies are discussed, along with a determination of whether or not they are viable options for use on the West Branch of the river. The viable options will be used for development into restoration alternatives. The sediment remediation technologies are screened for their effectiveness, implementability, and order-of-magnitude costs.

**Middle Waterway Sediments Problem Area Remedial Design, Commencement Bay, WA**

Task Manager. Tetra Tech was retained by a group of potentially responsible parties (PRPs) to perform CERCLA pre-remedial and remedial design (PRD/RD) for this problem area. Mr. Braun served as project manager and was responsible for the pre-design sampling, analysis, and Round 1A and 1B data evaluation, developing SOW, and initial cost estimates to perform the sediment evaluation work associated with Rounds 1A and 1B of the remedial design. Mr. Braun's expertise in the interpretation of sediment quality objectives and biological data (bioassays and benthic communities) contributed to the identification of areas that do not require further action, areas that are suitable for natural recovery, and areas that require removal. Two rounds of fieldwork were completed in May 1998 and October 1999. Sediment quality data were evaluated to determine a preliminary volume of sediments that may require removal and to support combined disposal of these sediments in a confined aquatic disposal (CAD) or nearshore disposal site. The information from the second round of sampling, in conjunction with the earlier data, is also being evaluated and used to refine the volumes of sediment that may require remediation and to determine potential remedial options for the waterway. These options may include no action areas, natural recovery areas, and areas of active remediation (e.g., capping, dredging). Technical elements of the remedial design include an evaluation of source control measures, a natural recovery analysis, an evaluation of potential disposal sites, a hydrographic survey, and the development of habitat mitigation plans. Mr. Braun's work on the high-profile Commencement Bay contaminated sediment project included interpretation of sediment quality objectives and biological data (bioassays and benthic communities), which contributed to the identification of areas that do not require further action, areas that are suitable for natural recovery, and areas that require removal.

**Niagara Mohawk Power Company, Sediment Investigation and Feasibility Study, Harbor Point, NY**

As Sediment Investigation Task Manager, reviewed and evaluated existing sediment chemical data for the sediment investigation task. Developed sampling and analysis plans to further delineate the extent of PAHs and PCBs in the Mohawk River, the Barge canal, and the Utica Terminal Harbor adjacent to the Harbor Point Former Manufactured Gas Plant Site; field sampling and analysis; and evaluation of the sampling results. Provided strategic technical consulting to client for development of site-specific sediment cleanup goals.

**Rayonier Corporation, Rayonier Remedial Investigation, Port Angeles, WA**

Prepared Marine Remedial Investigation Work Plan, Field Sampling Plan, and Quality Assurance Plans. Field Operations lead for field effort of the sediment and biota investigation at the former Rayonier mill site. Sediment investigation involved collection of core and surface samples to determine nature and extent of contaminants of concern in relation to SMS criteria. Analyses included toxicity bioassays at location with chemical exceedances. Biota sampling program involved collection of intertidal clams, subtidal clams, shrimp, crabs, and fish species.

**Niagara Mohawk Power Co., Supplemental Feasibility Study Field investigation, Queensbury, NY**

Chief Field Scientist for the field sampling for dredge material testing, which involved collection of subsurface cores, surface sediment samples, geotechnical borings, and collection of a sediment composite for contaminant mobility testing.

## OTHER PUBLICATIONS

Craigie, K., G. Braun, U. Ghosh, J. Gomez-Eyles, E. Ashley. 2015. Evaluation of Carbon Amendments to Reduce Bioavailability of PCBs and PAHs in Sediment. Paper presented at the Eighth Annual International Conference on Remediation of Contaminated Sediments, January 12-15, 2015.

- Craigie, K., G. Braun, R. Siegner, J. Occhialini. 2015. Establishment of a Baseline Porewater Data set for Long-Term Monitoring of In Situ Treatment. Paper presented at the Eighth Annual International Conference on Remediation of Contaminated Sediments, January 12-15, 2015.
- Abedi, H., L. Boreen, M. Kylo, V. Richards, R. Seamons, S. Ozkan, G. Braun, and W. McGinnis. 2015. Contaminated Sediment Dredging under a Marginal Wharf: A Challenging Case Study. Posterr presented at the Eighth Annual International Conference on Remediation of Contaminated Sediments, January 12-15, 2015.
- Braun, G., K. Craigie, R. Osgood, and S. Ozkan. 2013. Comparative Evaluation for Contaminated Sediment Sites to Guide the Remedial Decision Process. Paper presented at the Sediment Management Work Group Fall Sponsor Forum and Site Tour, Syracuse NY, October 1-3, 2013. In: A.K. Bullard and E.A. Stern (Conference Chairs), *Remediation of Contaminated Sediments—2013*. Seventh International Conference on Remediation of Contaminated Sediments (Dallas, TX; February 4–7, 2013). ISBN 978-0-9819730-6-7, ©2013 Battelle Memorial Institute, Columbus, OH. [www.battelle.org/sedimentscon](http://www.battelle.org/sedimentscon).
- Ashley, E.C., G. Braun, and I. Hutchinson. 2013. Use of Multiparameter Analysis Tools for Remedy Selection at a Contaminated Sediment Site. Paper presented at the Sediment Management Work Group Fall Sponsor Forum and Site Tour, Syracuse NY, October 1-3, 2013. In: A.K. Bullard and E.A. Stern (Conference Chairs), *Remediation of Contaminated Sediments—2013*. Seventh International Conference on Remediation of Contaminated Sediments (Dallas, TX; February 4–7, 2013). ISBN 978-0-9819730-6-7, ©2013 Battelle Memorial Institute, Columbus, OH. [www.battelle.org/sedimentscon](http://www.battelle.org/sedimentscon).
- Ashley, E.C., and G. Braun. 2013. The Big Picture Approach to Remedy Selection: A Quantitative Case Study of Evaluation, Decision Making and Effective Communication. Presentation at the Sediment Management Work Group Fall 2013 Conference. September 2013.
- Craigie, K., and G. Braun, 2013. Predicting Sediment Reactive Cap Design Life: A Case Study. Paper presented at the Sediment Management Work Group Fall Sponsor Forum and Site Tour, Syracuse NY, October 1-3, 2013. In: A.K. Bullard and E.A. Stern (Conference Chairs), *Remediation of Contaminated Sediments—2013*. Seventh International Conference on Remediation of Contaminated Sediments (Dallas, TX; February 4–7, 2013). ISBN 978-0-9819730-6-7, ©2013 Battelle Memorial Institute, Columbus, OH. [www.battelle.org/sedimentscon](http://www.battelle.org/sedimentscon).
- Craigie, K., G. Braun. 2013. Importance of Data, Objectives and Site Conditions in the Evaluation of Sediment Cap Effectiveness Modeling Results. Paper presented at the Annual International Conference on Remediation of Contaminated Sediments, February 4-7, 2013. . In: A.K. Bullard and E.A. Stern (Conference Chairs), *Remediation of Contaminated Sediments—2013*. Seventh International Conference on Remediation of Contaminated Sediments (Dallas, TX; February 4–7, 2013). ISBN 978-0-9819730-6-7, ©2013 Battelle Memorial Institute, Columbus, OH. [www.battelle.org/sedimentscon](http://www.battelle.org/sedimentscon).
- Ozkan, S. and G. Braun. 2013. Feasibility Level Seismic Stability Evaluation of Remedial Alternatives. Poster presented at the Annual International Conference on Remediation of Contaminated Sediments, February 4-7, 2013. . In: A.K. Bullard and E.A. Stern (Conference Chairs), *Remediation of Contaminated Sediments—2013*. Seventh International Conference on Remediation of Contaminated Sediments (Dallas, TX; February 4–7, 2013). ISBN 978-0-9819730-6-7, ©2013 Battelle Memorial Institute, Columbus, OH. [www.battelle.org/sedimentscon](http://www.battelle.org/sedimentscon).
- Ozkan, S., G. Braun, M. Kylo, H. Abedi, L. Battaglia, and B. Ginnis. 2012. Contaminated Sediments Dredging and Design Constraints Under A Marginal Wharf. Paper presented at PIANC COPRI Dredging Conference, San Diego, CA.
- Ozkan, S., and G. Braun. 2012. Feasibility Level Seismic Stability Evaluation of Dredge Cuts. Paper presented at PIANC COPRI Dredging Conference, San Diego, CA.
- Craigie, K., G. Braun, and J. Herzog, 2011. Determination of Site-Specific Background Based on Sediment Core Chemical Distribution Trends. Platform presentation, Sixth International Conference on Remediation of Contaminated Sediments, February 7-10, 2011. New Orleans, LA.
- McGee, S., G. Braun, C. Patmont, G. Berken, and J. Lawson. 2011. Evaluation of Sediment Residuals in OU3 of the Fox River Sediment Remediation Project. Platform presentation, Sixth International Conference on Remediation of Contaminated Sediments, February 7-10, 2011. New Orleans, LA.
- Sargent, P.M., G.M. Braun, and J. Smith. 2007. Use of Virtual Remediation for Alternative Evaluation: Recent Case Studies. Platform presentation, Fourth International Conference on Remediation of Contaminated Sediments.
- Braun, G., G.L. Hartman, B. Wallace, L. Hass, and B. Brickey. Design, Construction and Installation of Impermeable Isolation Cap for a NAPL Seep at the Head of the Thea Foss Waterway. Platform presentation, Third International Conference on Remediation of Contaminated Sediments, January 24-27, 2005. New Orleans, LA.

Gregory L. Hartman, Gary Braun, Bob Wallace, Lotte Hass and Bill Brickey. 2005. Impermeable Cap Design and Placement for NAPL Seep Isolation in the Thea Foss Waterway. In: Proceedings of the 2005 World Dredging Association Conference.

Braun, G. 2004. Puget Sound Sediment Cleanup – Technology Transfer Workshop, Case Study #11 Head of Thea Foss Waterway Remediation Project. Presentation, SMWG/U.S. Army Corps of Engineers Joint Conference, 2004, Seattle, WA.

Braun, G.M. and L. Hass Edgle. 2004. Head of the Thea Foss Waterway, A Capping Remediation Success Story. Presentation, Sediment Management Work Group Spring Sponsor Forum, Seattle, WA.



## Ronald J. Kotun, Ph.D.

### Risk Assessment

#### EXPERIENCE SUMMARY

Dr. Kotun is a risk assessment specialist, vapor intrusion specialist, and technical lead for the Risk/Toxicology Group with over 30 years of environmental experience. Dr. Kotun has prepared risk assessments and provided technical review for CERCLA- and RCRA-driven sites, state-driven RBCA programs, cost-recovery actions, property transfers, and voluntary remediation projects for a broad spectrum of clients including the Department of Defense (DOD) and wood-treating, steel, utilities, automobile manufacturing, chemical, and retail petroleum industries. His use of risk assessment has also been instrumental in establishing site-specific remedial objectives. He has negotiated with regulatory agencies and successfully achieved acceptance of practical and state-of-the-art approaches for risk assessment and cleanup level development. In addition, his work experience includes environmental fate and transport analysis, vapor intrusion modeling, technical review of proposed regulations, and statistical analysis. Dr. Kotun also participated in the activities of the Risk Assessment Subcommittee supporting Pennsylvania's Cleanup Standards Science Advisory Board to develop the state's Act 2 regulations.

**Risk Assessment Specialist:** Completed public health risk assessments and developed cleanup levels for more than 50 sites. Used site-specific exposure assessments, statistical analysis, Monte Carlo probabilistic analysis, geostatistics, and appropriate scientific information to arrive at realistic risk estimates and cleanup levels that reduce the extent of remediation and ultimately reduce remediation expenses. Has provided risk assessment support for wood-treating sites, manufactured gas plants, coke plants, steel manufacturing sites, retail petroleum sites, chemical facilities, automobile manufacturing facilities, utilities, and waste-disposal sites. Has been involved in negotiations with EPA Regions I, III, IV, V, and VIII and the following states: AL, CA, CO, DE, FL, GA, IL, IN, KY, MD, MA, MT, NJ, NY, NC, OH, OR, PA, RI, SC, TX, VA, WV, and WI. Has developed risk assessments for RFI/CMS, RI/FS, ASTM RBCA, and other various state regulations. Has worked with a variety of chemicals including polycyclic aromatic hydrocarbons (PAH), pentachlorophenol, dioxins, polychlorinated biphenyls (PCBs), pesticides, and metals.

**Project Manager:** Managed projects relating to remedial investigations, feasibility studies, and risk assessments for public and private sector clients. Projects ranged in duration from a few months to several years and ranged in cost from thousands to millions of dollars. Worked as an advocate for the client to ensure that projects were conducted in a timely manner and budgeted dollars were spent wisely.

**Vapor Intrusion:** Developed work plans for vapor intrusion investigations, evaluated risks associated with data collected for these investigations, and negotiated site-specific cleanup levels or assisted with remedy selection to address this exposure pathway.

#### EDUCATION

Ph.D.,  
Pharmacology/Toxicology,  
University of Pittsburgh, 1985

B.S., Chemistry, Carnegie  
Mellon University, 1980

#### AREAS OF EXPERTISE

Toxicology, Risk Assessment,  
Vapor Intrusion, Emerging  
Contaminants

#### REGISTRATIONS/ AFFILIATIONS

Society for Risk Analysis  
Society of Toxicology

#### TRAINING/CERTIFICATIONS

OSHA 1910.120 40-Hour  
HAZWOPER Training; June  
1990

OSHA 1910.120 8-Hour  
Annual Refresher Training;  
February 2005

#### OFFICE

Pittsburgh, PA

#### YEARS OF EXPERIENCE

31

#### YEARS WITH TETRA TECH

19

**Emerging Contaminants:** Monitors emerging contaminants such as perfluorinated compounds and 1,4-dioxane, regarding their toxicity, chemistry, and fate and transport properties to render determinations as to whether they pose significant impacts to human health and the environment.

**Statistical Analyst:** Reviewed and statistically analyzed data as part of a RCRA Groundwater Monitoring Program for several sites. Results of the statistical analyses provided the technical support necessary for negotiating reductions in monitoring programs. This has translated into significant savings in field and analytical costs. Also reviewed and statistically analyzed data to demonstrate attainment of cleanup levels at various sites even though select sample concentrations exceeded the target level.

**Legal Review:** Prepared comments on proposed regulations on behalf of industrial parties to help influence changes that would result in fair application and reasonable implementation of the law. Also prepared interrogatories on behalf of responsible parties to support depositions and pending litigation.

## **RELEVANT EXPERIENCE**

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### **Risk Assessment**

**Vapor Intrusion Specialist; Confidential Client (Lockheed Martin Corporation); Baltimore, Maryland; May 2011 to Present; \$600,000.** Technical lead for an extensive vapor intrusion investigation at an active facility. Using groundwater, soil gas, and indoor air data to gain a better understanding of the potential for vapor intrusion and evaluating the potential health risks to workers. Have used portable GC/MS technology to better define the location of potential sources of contaminants. Work with a multidisciplinary team to interpret data and convey this information to workers at the facility. Also have interaction with Maryland Department of the Environment (MNE) to gain acceptance for sampling strategy and determining appropriate mitigation actions.

**Senior Risk Assessment Specialist; Environmental Health Assessment; U.S. Navy NAVFAC Atlantic, NSA Naples; Naples, Italy; March 2008 to 2014, \$27 Million.** Acted as lead risk assessment specialist for a team conducting investigations to address public health issues for civilian and military personnel. Addressed issues associated with public burning of trash and potential risks associated with exposure to tap water, soil, soil gas, and particulates in air. Entailed the preparation of investigation work plans and a human health risk assessment, served as a project liaison in Italy between Navy personnel and Tetra Tech staff, and presented to military leadership and at public meetings.

**Risk Assessment Specialist; Superfund-Related Investigations; U.S. Navy, NAVFAC Southeast, Marine Corp Recruit Depot, Parris Island, South Carolina; January 2012 to Present, \$200,000.** Acts as a lead risk assessment specialist for a team conducting investigations at various sites across the base. Sites have been contaminated with volatile organic compounds, polynuclear aromatic hydrocarbons, pesticides, metals, and PCBs. Using site-specific characteristics and statistical analysis to demonstrate attainment of protection of public health and the environment and to minimize the extent of remediation. Vapor intrusion evaluations have also been conducted. Assisted in the development of Remedial Investigations, Feasibility Studies, and Proposed Plans.

**Senior Risk Assessment Specialist; National Aeronautics and Space Administration (NASA), John F. Kennedy Space Center; Kennedy Space Center, Florida; July 2015 to Present, \$45,000.** Using probabilistic risk analysis (Monte Carlo simulation) and site-specific exposure assumptions to derive alternate soil cleanup target levels.

**Senior Risk Assessment Specialist; RCRA Facility Investigations (RFI); U.S. Navy NAVFAC Southeast/CLEAN III, NAS Pensacola; Pensacola, Florida; November 2006 to 2011, \$150,000.** Acted as lead risk assessment specialist for a team conducting investigations at the facility. Used Florida Department of the Environment Global Risk-Based Correction Actions (RBCA) to determine risks and determine which Risk Management Option (RMO) was appropriate.

**Senior Risk Assessment Specialist; Superfund-Related Investigations; U.S. Navy NAVFAC Southeast/CLEAN III, NAS Jacksonville; Jacksonville, Florida; January 1999 to Present, \$150,000.** Acts as lead risk assessment specialist for a team conducting investigations at the facility. Using site-specific characteristics and statistical analysis to demonstrate attainment of protection of public health and the environment and to minimize the extent of remediation. Also using FDEP Global RBCA regulations to determine which Risk Management Option (RMO) is appropriate and consequently determine which sites can achieve No-Further Action status. Evaluating potential health issues associated with vapor intrusion.

**Senior Risk Assessment Specialist; Human Health and Ecological Risk Assessment and Supplemental Remedial Investigation; U.S. Navy NAVFAC Atlantic; NAVSTA Newport, Newport, Rhode Island; January 2008 to 2010, \$50,000.** Acted as lead risk assessment specialist for a team conducting investigations to update existing data and to redefine the nature and extent of contamination that reflects where removal actions were implemented. Prepared a work plan using the UFP-SAP format. Used results of the investigation to prepare a human health and ecological risk assessment.

**Senior Risk Assessment Specialist; Remedial Action Plans; Confidential Client (Lockheed Martin Corporation); Baltimore, Maryland; May 2006 to 2010, \$75,000.** Evaluated data collected for a Site Characterization Report to establish site-specific remedial goals to attain clean closure under the Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP) while minimizing the extent of remediation. The facility is located on valuable waterfront property resulting in the financial decision to sell the property for redevelopment for residential and office use. Successful negotiation with MDE has already resulted in scaling down the remedial effort to focus only on source control.

**Senior Risk Assessment Specialist; RCRA Part B Permit Application; Aberdeen Proving Ground; Aberdeen, Maryland; February 2005 to 2008, \$100,000.** Prepared a risk assessment in accordance with EPA's "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities" for Open Burn/Open Detonation units to be included in a RCRA Part B permit application. Presented the results to regulatory officials.

**Senior Risk Assessment Specialist; United States Coast Guard; USCG Integrated Support Command (ISC); Portsmouth, Virginia; December 2005 to 2008, \$25,000.** Prepared a risk assessment to demonstrate that the presence of diesel range organics did not pose a significant risk to human health and the environment and that no further action was needed at the site.

**Senior Risk Assessment Specialist; Superfund-Related Investigations; U.S. Navy NAVFAC Southeast/CLEAN III, NAS Cecil Field; Jacksonville, Florida; January 1999 to 2010, \$500,000.** Acted as lead risk assessment specialist for a team conducting investigations at the facility. Used site-specific characteristics, statistical analysis, and geostatistics to demonstrate attainment of protection of public health and the environment and to minimize the extent of remediation. Also used FDEP Global RBCA regulations to determine which Risk Management Option (RMO) was appropriate and consequently determined which sites could achieve No-Further Action status. Received a letter of commendation from the Florida Environmental Partnering Alliance. Received the Chief of Naval Operations (CNO) FY 2007 Environmental Award for the Environmental Restoration Category—Team Category as a participant in the activities of the Cecil Field BRAC Cleanup Team

**Senior Risk Assessment Specialist; National Aeronautics and Space Administration (NASA), John F. Kennedy Space Center; Kennedy Space Center, Florida; August 2003 to 2010, \$15,000.** Provided technical human health risk assessment support for all environmental programs at NASA for Tetra Tech NUS. All work was conducted under the Florida HSWA program. Addressed lead contamination issues at a firing range.

**Senior Risk Assessment Specialist; U.S. Navy NAVFAC Atlantic/CLEAN; Portsmouth Naval Shipyard, Kittery, Maine; 2004 to 2010, \$10,000.** Evaluated risk assessment data and used statistical applications to establish site-specific remedial goals and minimize the extent of remediation. The approach being presented was new for Maine and EPA Region 1.

**Senior Risk Assessment Specialist; Basewide Environmental Screening Assessment for BRAC Closure; U.S. Navy NAVFAC Southeast/CLEAN III; Naval Research Laboratory, Orlando, FL; April 1999 to 2008, \$60,000.** The objective of this project was to determine the impact historical operations may have had on the site at two Naval Research Laboratory (NRL) Underwater Sound Reference Detachments. The facilities are part of the approved 1995 Base Realignment and Closure (BRAC) IV Act and are being investigated under the Navy's Installation Restoration Program to determine their actual environmental conditions. Addressed human health risk issues associated with groundwater contamination. Engaged in fate and transport analysis to demonstrate that there were no significant impacts to the human health of potential offsite receptors. The site is located in a highly populated area, which resulted in the preparation and distribution of Fact Sheets and presentations and interactions with the community, county representatives and the FDEP.

**Senior Risk Assessment Specialist; Charleston Air Force Base; U.S. DOD, Department of the Air Force Installation Restoration Program (IRP)/ Air Force Center for Environmental Excellence (AFCEE); Charleston, South Carolina; February 1999 to 2007, \$55,000.** Provided technical support for human health risk assessment issues associated with the investigation and remediation of numerous solid waste management units. The sites included pesticide management units, dump sites, landfills, hardfills, and fire training areas.

**Senior Risk Assessment Specialist; Engineering Evaluation/Cost Analysis; U.S. Navy NAVFAC Atlantic/CLEAN; Annapolis, Maryland; November 2000 to 2005, \$25,000.** Evaluated potential human health risk in support of an Engineering Evaluation/Cost Analysis (EE/CA) for a site in Maryland contaminated with lead paint. Sixteen now-dismantled radio towers were historically sandblasted during routine maintenance and painting. Sand blasting resulted in significant release of lead-based paint to the surrounding area. Objective was to minimize the amount of remediation that would be required to attain the remedial objective of protecting public health and the environment.

**Senior Risk Assessment Specialist; Remedial Investigation (RI), and Community Relations Program; U.S. Navy NAVFAC Atlantic/CLEAN; Nebraska Avenue Complex, Washington, DC; April 2001 to 2003, \$10,000.** Provided technical support for human health risk assessment issues. The site was contaminated due to past transformer draining activities. The investigation covered areas where PCB transformer oil was released to the ground and where a removal action was completed. Areas that were affected included soils and sediment that covered a one-acre area within a park adjacent to a stream. Community relations activities included public interaction through Restoration Advisory Board meetings, development of a fact sheet, and updating a community relations plan.

**Risk Assessment Specialist and Toxicologist; Human Health Risk Evaluation of Air Emissions; Plaskolite Industries, Inc.; Columbus, Ohio; January 2001 to October 2002, \$50,000.** Acted as lead risk assessment specialist and toxicologist for a team evaluating the potential impacts of air emissions from a plastics manufacturing plant to neighboring residents. Used air monitoring samples to evaluate risk; determined that risks were insignificant to neighbors despite the presence of odors from the emissions. Data and results used in cooperation with company to assist in implementing engineering controls for odors. Worked directly with the public to define the sampling plan and define how the data would be evaluated. Presented the results at a public meeting.

**Senior Risk Assessment Specialist; RFI; U.S. Navy NAVFAC Southeast/CLEAN III; Naval Ordnance Station; Louisville, Kentucky; April 1997 to December 2003, \$200,000.** Acted as lead risk assessment specialist for a team conducting an RFI. Developed a Risk Assessment Work Plan that established the protocol to be used in evaluating risk. Negotiated with regulatory agencies to arrive at approach that used "best-science" and practicality.

**Senior Risk Assessment Specialist; RFI; U.S. Navy NAVFAC Southeast/CLEAN III; NAS Key West; Key West, Florida; April 1997 to December 2003, \$25,000.** Acted as lead risk assessment specialist for a team conducting an RFI. Various metals, volatile organic compounds and semivolatile organic compounds are distributed across the site. The risk assessment results were used to determine which SWMUs would require remediation or further assessment in the CMS.



**Risk Assessment Specialist; Development of Risk-Based Cleanup Levels; Wood Treating Site; Virginia; January 1990 to March 1996, \$15,000.** Developed site-specific risk-based cleanup levels for pentachlorophenol, arsenic, and carcinogenic polyaromatic hydrocarbons (PAHs) for a wood treating site. Used probabilistic risk assessment to arrive at the risk-based cleanup values.

**Risk Assessment Specialist; Risk Assessment Review for Cost Recovery Litigation; Various Sites.** Reviewed risk assessment for consistency with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for sites in EPA Regions III, IV, and V in anticipation of cost recovery litigation.

**Risk Assessment Specialist; PA Act 2 Closure; Retail Petroleum Site; Pennsylvania; February 1995 to March 1997, \$25,000.** Prepared a risk assessment in accordance with Pennsylvania's Act 2 regulations (Land Recycling Act) to demonstrate that soil remediation would not be required.

**Risk Assessment Specialist; Remedial Investigations; Major Natural Gas Distributor; Pennsylvania; 1992-1996, \$100,000.** Prepared a template preliminary risk assessment for inclusion in a generic work plan that would be used to investigate 20 former manufactured gas plant sites. Developed soil and groundwater action levels for use in screening data collected at the sites and determining whether additional investigations would be required. Prepared site conceptual model, as part of site work plans, that was used to focus the site investigations. Principal contaminants of concern included PAHs, VOCs, and metals. Negotiated site-specific cleanup levels with regulators on behalf of client.

**Risk Assessment Specialist; Superfund Risk Assessments; Chemical Manufacturing Site and Waste Disposal Site; Pennsylvania; January 1993 to April 1997, \$30,000.** Prepared streamlined risk evaluations for two sites in Pennsylvania to demonstrate that Removal Actions would not be required.

**Risk Assessment Specialist and Project Manager; Remedial Investigation; Manufactured Gas Plant; Maryland; 1991-1993, \$50,000.** Conducted an investigation at a former manufactured gas plant, prepared a risk assessment and assessed remedial alternatives to achieve protection of human health and the environment.

**Risk Assessment Specialist; RCRA Clean Closure; Wood Treating Facilities; PA, West Virginia; April 1989 to April 1991, \$25,000.** Prepared risk assessments for remediated surface impoundments at wood treating facilities to obtain "Clean-Closure" status. "Clean" was defined by showing that remaining contaminants posed negligible risks.

**Senior Risk Assessment Specialist; RI/FS - Melville North Landfill; U.S. Navy, NAVFAC Atlantic/CLEAN; Naval Education Training Center, Newport, Rhode Island; April 1997 to September 1997, \$20,000.** Acted as lead risk assessment specialist for a team conducting an RI for a landfill containing spent acids, waste paints, solvents, waste oils and PCBs. The risk assessment was performed in light of the site being developed into a marina. Future construction workers are likely to experience adverse health effects as a result of exposure to soil.

**Risk Assessment Specialist; Development of Risk-Based Cleanup Levels; Wood-Treating Site; Colorado; January 1993 to March 1997, \$150,000.** Conducted a risk assessment, developed site-specific risk-based cleanup levels and a level protective of groundwater. Constituents of interest were pentachlorophenol, PAHs, dioxins and arsenic. The soil level protective of groundwater was developed using the Summers Model.

**Risk Assessment Specialist; Implementation of Groundwater Treatment System (Interim Remedial Measures); Wood-Treating Site; Colorado; February 1995 to April 1995, \$50,000.** Prepared a risk assessment to demonstrate that emissions from a groundwater treatment process would not adversely affect human health and the environment. Emissions were modeled from groundwater concentrations, and the Point Source Gaussian Diffusion Model (PTPLU model) was used to estimate downwind concentrations.

**Risk Assessment Specialist; Alternate Concentration Limits Standards; Coke and Byproducts Facility; New Jersey; April 1990 to April 1995, \$100,000.** Established Alternate Concentration Limits (ACLs) for

groundwater at a former coke and byproducts plant that are protective of the adjacent river. Also established Alternate Cleanup Standards (ACS) for soil in accordance with the State's Industrial Site Recovery Act (ISRA) and proposed N.J.A.C. 7:26D that were site specific and risk-based.

**Risk Assessment Specialist; Remedial Investigation; Former Manufactured Gas Plant; Vancouver, British Columbia; 1989-1990, \$75,000.** Prepared a risk assessment for a former manufactured gas plant site in British Columbia that was being developed as a residential development and public park. Principal site contaminants were PAHs. Developed site-specific cleanup goals.

**Risk Assessment Specialist; Regulatory Negotiation; Wood Treater; Illinois; February 1992 to May 1994, \$125,000.** Negotiated with the Illinois EPA on behalf of our client to demonstrate that dioxins/furans were not an issue of concern in streams adjacent to a wood-treating facility. Used the bioavailability index to illustrate this issue.

**Risk Assessment Specialist; Risk Assessments for Property Transfer; Automotive Manufacturers; Wisconsin, Michigan; January 1990 to December 1993, \$100,000.** Conducted risk assessments for automotive manufacturers to define the nature and extent of contamination for purposes of property transfer. Demonstrated that properties posed "negligible" risks and were clean under a "no action" alternative. Also reviewed risk assessments prepared by the buyer to ensure that risks were assessed in accordance with future land use.

**Risk Assessment Specialist; Application for Removal Credits; Steel Manufacturer; Illinois; January 1994 to May 1996, \$50,000.** Prepared a risk assessment to derive sewage pollutant loading limits for phenolic compounds in accordance with 40 CFR Part 503 (Sewage regulations). Measured loading rates were less than the derived limits that correspond to the exposure pathways associated with known sludge applications. Removal credits were granted by EPA to the steel manufacturers for phenolic compounds..

**Risk Assessment Specialist; Scoping Document for Risk Assessment; Wood-Treating Site; Montana; April 1990 to June 1992, \$30,000.** Prepared a "scoping document" for the EPA presenting the client's position on how risks should be assessed at a site in Montana. Demonstrated a proactive approach that may counter EPA's technical policy, but represented best science.

**Risk Assessment Specialist; Hazardous Waste Delisting; Steel Manufacturer; New York; December 1990, \$25,000.** Assisted a steel manufacturer petition for a hazardous waste delisting. Provided the technical support and comments to demonstrate that the proposed health-based standard for benzo(a)pyrene was of dubious technical merit. Demonstrated that the technical data did not support the unilateral use of this standard as a basis for the proposed denial of the manufacturer's petition when compared with listing criteria.

**Risk Assessment Specialist; Remedial Objective Development; Window-Treating Facility; Wisconsin; June 1989 to May 1991, \$40,000.** Developed risk-based remedial objectives for pentachlorophenol and dioxins in groundwater for a window-treating facility in Wisconsin.

**Risk Assessment Specialist; RFI; Wood Treating Site; South Carolina; February 1991 to February 1994, \$100,000.** Prepared a risk assessment as part of a RCRA Facility Investigation (RFI) for a RCRA site. Site was primarily impacted with PAHs. Regulatory agency was performing the official risk assessment; therefore a parallel risk assessment was prepared using appropriate assumptions in order to expeditiously prepare public comments on the agency's risk assessment.

**Data Reviewer; Liability Data Review; Superfund Waste Disposal Site; New Jersey; June 1992, \$25,000.** Reviewed data from a Superfund waste disposal site on behalf of a potentially responsible party (PRP) (automobile manufacturer) to prepare an affidavit that reduced an apportionment of liability.

**Statistical Analyst; RCRA Groundwater Monitoring Program; Multiple Facilities; Various States; January 1990 to March 1997.** Groundwater data collected as part of RCRA Groundwater Monitoring Programs were reviewed and statistically analyzed. Results of the analysis provided the technical support necessary for

negotiating reductions in monitoring programs. This translated into significant savings in field and analytical costs.

**Statistical Analyst; Compliance with PA Residual Waste Regulations; Utility Company; Pennsylvania; March 1994 to February 1995, \$50,000.** Groundwater data were reviewed in accordance with Pennsylvania's Residual Waste Regulations to determine whether groundwater quality had "degraded." With the advent of Pennsylvania's Act 2 legislation, regulatory and technical oversight has been provided to explore options that demonstrate that ash disposal sites and other areas were not adversely affecting groundwater quality.

### RI/FS

**Project Manager; RFI/CMS; U.S. Navy NAVFAC Atlantic/CLEAN; NSWC White Oak; Silver Spring, Maryland; December 1998 to December 2005, \$1,300,000.** Managed a multi-site RFI for a facility that is being transferred for private use. Involved work plan development, an extensive field investigation, quarterly groundwater monitoring, preparation of a RFI/CMS, preparation of a basewide ecological risk assessment, preparing Proposed Plans and Records of Decision, and conducting public meetings. Flexibility in the investigation was critical in expediting the transfer of priority sites. Received a letter of commendation from the Maryland Navy Tier II Partnering Team for achieving goal of bringing sites to closure.

**Project Manager; Explosives Survey; U.S. Navy NAVFAC Atlantic/CLEAN; NSWC White Oak; Silver Spring, Maryland; February 2000 to October 2000, \$250,000.** Managed the preparation of a document presenting the results of an investigation of the presence of explosive contaminants in media surrounding buildings known to have been involved with explosives research.

**Project Manager and Senior Risk Assessment Specialist; Risk Assessment and Air Transport Modeling; Urban Redevelopment Authority; Ninemile Run Slag Site; Pittsburgh, Pennsylvania; April 1997 to June 1999, \$250,000.** Conducted a risk assessment in accordance with Pennsylvania Act Two regulations to demonstrate that the slag site can be developed into a residential community. Risks associated with metals and PAHs present in the slag pose insignificant risks to future construction workers and adjacent offsite residents. Air transport modeling associated with known future construction activities was conducted to demonstrate air concentrations of contaminants would not impact human health. Partnered with PADEP to facilitate development of this "brownfield."

### Vapor Intrusion

**Vapor Intrusion and Risk Assessment Specialist; Superfund-Related Investigations; U.S. Navy, NAVFAC Southeast, Marine Corp Recruit Depot, Parris Island, South Carolina; June 2011 to Present, \$35,000.** Acts a lead risk assessment and vapor intrusion specialist for a team conducting vapor intrusion investigations to on-base public health issues. Reviewing results of an investigation conducted at a former dry cleaning facility and using the results of a human health risk assessment to assist with remedy selection.

**Vapor Intrusion and Risk Assessment Specialist; Superfund-Related Investigations; U.S. Navy, NAVFAC Southeast, MCLB Albany; Albany, Georgia, May 2011 to 2014, \$50,000.** Acted as lead risk assessment and vapor intrusion specialist. Used building characteristics, exposure assumptions, groundwater characterization, and Johnson and Ettinger mode as multiple lines of evidencel to demonstrate that vapor intrusion investigation was not warranted.

**Vapor Intrusion and Risk Assessment Specialist; Environmental Health Assessment; U.S. Navy NAVFAC Atlantic, NSA Naples; Naples, Italy; March 2008 to 2014, \$27,000,000.** Acted as lead risk assessment and vapor intrusion specialist for a team conducting vapor intrusion investigations to address public health issues for civilian and military personnel. Investigated individual residences "on the economy" (off-base) and on-base buildings. Entailed the preparation of a UFP-SAP for the vapor intrusion investigation, evaluating the results of the investigation with regards to potential risks to human health, and presenting the results to Navy officers and the public.

**Vapor Intrusion Specialist; RFI; U.S. Air Force, AFCEE, Joint Base McGuire-Dix-Lakehurst, New Jersey; November 2011 to Present, \$25,000.** Prepared a work plan to address the vapor intrusion investigation of 12 sites. The sites have been the locations of past operations involving the storage (e.g., USTs and ASTs), handling (e.g., associated piping) or use of various petroleum products and (in some cases) other potentially hazardous substances. Records indicate that leaks and spills of these materials are known or are suspected to have occurred that may have impacted the soil and groundwater at these sites. A site-specific NJDEP Vapor Intrusion (VI) Report will be prepared in accordance with established regulatory requirements

**Vapor Intrusion and Risk Assessment Specialist; RI/FS for Flash Dry Cleaning Facilities, West Palm Beach, FL; U.S. EPA RAC (Region IV); April 2008 to 2011, \$25,000.** Developed the work plan for the vapor intrusion investigation and conducted the risk assessment at a dry cleaning facility where a tetrachloroethylene plume was migrating from the dry cleaning facility. Evaluated risks associated with the tetrachloroethylene plume for on-site and off-site receptors and reviewed the data to evaluate the impacts associated with vapor intrusion.

**Vapor Intrusion and Risk Assessment Specialist; Vapor Intrusion Investigation; Anniston Army Depot (ANAD); U.S. Army; Anniston, AL, September 2008 to 2013, \$30,000.** Assisted in the development of the work plan for the vapor intrusion investigation.

**Consultant for Vapor Intrusion Decision Tool; U.S. Navy NAVFAC; July 2009 to 2013, \$10,000.** Assisted in development of a vapor intrusion resource to support Navy RPMs addressing vapor intrusion. Offered technical input into the development of a Vapor Intrusion Web Tool.

### Training

**Instructor and Program Developer; EPA Environmental Resources Training Program (ERTP); May 2004 to Present, \$1,500,000.** Serving as an instructor for the ERTP course, Introductory Risk Assessment Guidance for Superfund (IRAGS). Also provides technical support for developing and modifying the course based on suggestions and comments from students and EPA staff.

### Technical Reviews

- Prepared technical comments on the proposed RCRA CMS regulations on behalf of our client to ascertain that technical integrity was maintained.
- Prepared technical comments on the proposed Land Disposal Restriction (LDR) regulations to demonstrate that site-specific risk-based standards are more appropriate than action levels.
- Prepared technical comments to dissuade the proposed use of results from Method 1312, the Synthetic Precipitation Leaching Procedure, as a means for direct comparison to action levels and assessment of mobility.
- Summarized a Technology Support Document on Methodologies for Human Health Criteria and Values as part of the Great Lakes Initiative (GLI) for a consortium of Great Lakes industries.

### Data Validation

Performed data validation for Superfund-driven remedial investigations.

## **SCIENTIFIC/TECHNICAL PUBLICATIONS**

Kotun, Ronald J., "Calculating a More Refined and Representative Risk Estimate," Joint Services Environmental Management Training Conference and Exposition, Denver, CO, May 2008.

Kotun, Ronald J., "Using Geostatistics and Risk Assessment to Minimize Remediation," Joint Services Environmental Management Training Conference and Exposition, Columbus, OH, May 2007.

Kotun, Ronald J., "Using Geostatistics and Risk Assessment to Minimize Remediation," presented at the Air Force 2006 Environmental Training Symposium, Pittsburgh, PA, March 2006.

Kotun, Ronald J., "Establishing a Cleanup Level for Lead at a Former Firing Range," presented at the Region 3 EPA DOD Environmental Colloquium, Williamsburg, VA, September 2003.

Kotun, Ronald J., "From Slag Dump to Residential Development: Risk Assessment's Role," presented at Brownfields 2002: Investing in the Future, Charlotte, NC, November 2002.

Kotun, Ronald J., Speranza, M.P., Jonnet, M., "Using Geostatistics and Risk Assessment to Minimize Remediation," presented at the Society for Risk Analysis Annual Meeting, Seattle, WA, December 2001.

Kotun, Ronald J., "Using Geostatistics and Risk Assessment to Minimize Remediation," presented at the 18th Annual International Conference on Contaminated Soils, Sediments and Water, Amherst, MA, October 2001.

Gromicko, G. J., R. J. Kotun, and J. J. Mahfood, "Remediation Strategy Using Intrinsic Bioremediation for a Former MGP Site," presented at the In Situ and On-site Bioremediation Symposium, New Orleans, LA, May 1997.

Kotun, R. J., "Using Monte Carlo Simulation to Derive Risk-Based Cleanup Levels," presented at the Superfund XVII Conference and Exhibition, Washington, D.C., October 1996.

Kotun, R. J. et al., "Innovative Approaches for Cleanup Level Development." In: Process Engineering for Pollution Control and Waste Minimization, Marcel Dekker, Inc., Eds.: Wise, D.L. and Trantolo, D.J., 1994.

Kotun, R. J. and J. J. Mahfood, "Deriving a Practical and Cost-Effective Soil Remedial Goal for Carcinogenic PAHs," presented at the Superfund XV Conference and Exhibition, Washington, DC, December 1994.

Kotun, R. J., et al., "A Decision Flow Chart for Cleanup of Multiple Manufactured Gas Plant Sites," presented at the Federal Environmental Restoration III and Waste Minimization II Conference and Exhibition, New Orleans, LA, April 1994.

Kotun, R. J., "Comparison of Site-Specific Cleanup Goals to Proposed Uniform Cleanup Standards," presented at the Superfund XIV Conference and Exhibition, Washington, DC, December 1993.

Kotun, R. J., and R. J. Jupin, "An Innovative Approach to Derive Risk-Based Cleanup Levels for Carcinogenic PAHs," presented at the National R&D Conference on the Control of Hazardous Materials, San Francisco, CA, February 1992.

Kotun, R. J., et al., "Critical Issues and Influential Parameters Determined from Assessing Risks Posed by PAHs in Soil/Sediment for Over 30 Sites," presented at the International Specialty Conference on Managing Environmental Risks, Quebec City, Quebec, November 1989.

## **CHRONOLOGICAL HISTORY**

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**Senior Risk Assessment Specialist; Tetra Tech NUS, Inc.; Pittsburgh, Pennsylvania; March 1997 to Present.**

**Senior Toxicologist; Fluor Daniel GTI (formerly Groundwater Technology Industries, Chester Environmental and Keystone Environmental Resources); Pittsburgh, Pennsylvania; April 1989 to March 1997.** Managed Risk Assessment group, performed human health risk assessments, developed site-specific cleanup levels, and conducted statistical analysis. Worked solely for private clients. Negotiated with regulatory agencies on behalf of industrial clients to achieve practical and cost-effective solutions that attained protection of public health and the environment with minimal remediation.

**Senior Associate; ICF Kaiser (formerly ICF Clement); Fairfax, Virginia; August 1988 to April 1989.** Performed risk assessments, prepared ATSDR Toxicological profiles, and assisted in the preparation of regulatory agency policy documents.

**Corporate Toxicologist; CSC; Pittsburgh, Pennsylvania; August 1985 to August 1988.** Performed toxicological reviews of data and assisted companies in the compliance with SARA regulations.

**EXPERIENCE SUMMARY**

Ms. Arabia has more than 24 years of experience in site investigations, chemical analysis, environmental fate and transport analysis, quality assurance/quality control (QA/QC), field screening headspace and immunoassay analyses, and electronic data formatting for numerous multi-task projects. Ms. Arabia has been responsible for the preparation or independent senior-level technical review of Work Plans, Field Sampling Plans, Quality Assurance Project Plans, conceptual site models, ASTM Phase I Environmental Site Assessments (ESAs), and comprehensive reports. Ms. Arabia has also been responsible for site chemistry assessments, implementation of field programs, data usability and validation reviews, and data analysis evaluations. In addition, Ms. Arabia is the present CES Group Discipline Lead for Chemistry, and Office Sciences Lead and Chemistry Group Lead for the Morris Plains office, and is responsible for providing technical expertise, supervising staff personnel, and reviewing chemistry-related documents.

**RELEVANT EXPERIENCE****Quality Control/Technical Support, Foster Wheeler, Inc., Former Ullrich Copper Facility, Kenilworth, NJ**

Providing technical support and senior-level review for Soil Remedial Action under NJDEP to remove non-hazardous soil from several properties on and adjacent to the former Ullrich Copper facility pursuant to the New Jersey Industrial Site Recovery Act (ISRA). Managed receipt of post-excavation laboratory data and compared results to state screening criteria to determine if additional activities were warranted. Constituents of concern (depending on property) included metals (arsenic, antimony, copper, lead, and/or selenium); PCBs; VOCs (chlorobenzene, PCE, and/or TCE); benzo(b)fluoranthene; and extractable petroleum hydrocarbons (EPH). Performed senior-level QC review of three separate Remedial Action Reports for the multiple properties, which presents the remediation activities conducted, following N.J.A.C. 7:26E Technical Requirements for Site Remediation.

**Quality Control Manager, U.S. Army Corps of Engineers (USACE), Kansas City District, HTRW, MEGA Phase A and TriEco TT JV Contracts**

Responsible for QC associated with all task orders within these three HTRW-related contracts, specifically noting, documenting and immediately reporting any conditions that impact the quality of work or data. Implements the Quality Management Program. Performs and/or coordinates independent senior-level technical reviews of documents by appropriate scientific and/or engineering technical support disciplines. Coordinates staffing of projects as necessary to perform required QC tasks. Also has the responsibility and authority for establishing technical standards and procedures, implementation and maintenance of Standard Operating Procedures (SOPs), and preparing and updating technical guidance documents. Ensures the incorporation of all client comments to plans, procedures, reports, and/or other documents submitted.

**Quality Control Officer, New York City School Construction Authority, Multiple Projects, NY**

Responsible for the overall management of the activities to ensure the quality of work associated with a multi-task order, on-call environmental consulting and engineering program that included 19 Phase I ESAs (at sites ranging from parking lots to multi-story buildings); 8 Phase II Environmental Site Investigations (ESIs); 5 aboveground and underground storage tank inspections and closures; 4 indoor and 3 outdoor air quality assessments; 4 soil, vapor and/or groundwater remedial designs; and other activities as requested by NYCSCA. Performed (or facilitated the performance of) appropriate technical reviews including reviewing, inspecting or otherwise verifying the assumptions, accuracy, level of complexity, correctness, and completeness of methods, data, calculations, etc. and their compliance with approved plans and accepted scientific procedures, standards and guidelines, along with confirming the proper application of criteria, regulations, laws, codes, principles, and professional procedures.

**EDUCATION**

BS, Chemistry (Minor: History),  
Massachusetts Institute of  
Technology, 1992

**REGISTRATIONS**

Certified Hazardous Materials  
Manager, US, Number 15710,  
Expires June 2016

**AFFILIATIONS**

Member, American Chemical  
Society, Division of  
Environmental Chemistry, 1992

**YEARS OF EXPERIENCE**

24



**Quality Control Officer, Joint Base McGuire-Dix-Lakehurst, NJ**

Responsible for the overall quality control of five separate Work Plans for Remedial Investigation (RI) or Engineering Evaluation/Cost Analysis (EE/CA) at multiple Munitions Response Sites (MRSs) under this \$4.2M FFP contract. Field activities will include geophysical investigation for MEC; and direct push drilling, hand augering/soil coring, and soil sampling and analysis; monitoring well installation and groundwater sampling and analysis; and sediment and surface water sampling and analysis for MC. Results will be used as the basis for a proposed plan for the each MRS, including the potential performance of non-time critical removal actions (NTCRAs). Provided technical lead expertise and independent quality review during scoping of the investigations, preparation of the draft plans (Work Plan, Field Sampling Plan and UFP-QAPP), consolidation of various internal author sections, submission to multiple stakeholders, and revision based on regulatory comments, including direct interaction with USACE and Base personnel.

**QA Chemist, Responsible Parties, Lower Fox River and Green Bay Site, WI**

Prepared comprehensive Uniform Federal Policy (UFP) format QAPP for the remediation of PCBs in this multiple operable unit multi-year remedial design/remedial action. The QAPP provided a summary of the required sampling and analytical activities to be implemented for the project, compiling the analytical methods, procedures and QA/QC requirements from numerous planning documents, addenda, and/or technical memoranda. Analytical constituents discussed were primarily PCBs (as Aroclors) and/or PCB congeners in dredged sediments, post-treatment solids and waters, surface water, and air, along with beneficial reuse (metals, pesticides, dioxins/furans), geotechnical, and water quality parameters. Coordinated with laboratories in regard to QC requirements during the procurement process. Currently providing chemistry-related technical support to project on an as-needed basis.

**QC Chemist, USAID, Environmental Remediation at Da Nang Airport: Excavation and Construction, Vietnam**

Coordinated development of a Quality Assurance/Quality Control Plan for the remediation of dioxin “hotspots” in areas within the airport. Prepared plan to ensure that project activities during the procurement, construction and restoration phases of the remediation work would be implemented effectively and in accordance with U.S. and Vietnam standards and regulations. Discussed the quality organization, including the names, qualifications, duties, responsibilities, reporting, and authority of each person assigned to perform QA/QC functions; control, verification, and acceptance of testing procedures for each specific test to be performed; checklists of duties to be performed by the supervisory staff and senior employees; procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors; requirements for countermeasures or corrective action that must be taken to correct any quality deficiencies that are identified; and requirements for daily and weekly surveillances and reporting to determine if the various services are being performed according to the contract.

**Remedial Investigation Lead, USEPA, Cornell-Dubilier Electronics Superfund Site, South Plainfield, NJ**

Responsible for the technical management and supervision of a multi-operable unit, multi-task RI/FS at a former electronics manufacturing facility contaminated with PCBs, chlorinated solvents and metals. Prepared project plans, cost estimates, and subcontractor procurement specifications. Supervised the collection/analysis of residential surface soil, geophysical, soil gas, building dust, surface and subsurface soil, groundwater, and catch basin sediment/water samples. Performed the tabulation, review and usability evaluation of chemical data results. Compiled all investigation result information into two comprehensive RI Reports, including comparison of site chemical results to federal and state guidance values; determination of the nature/extent of contamination and fate/transport of chemical constituents; and development of isoconcentration contour figures. Also prepared a comprehensive Conceptual Site Model that summarized 10+ years of sediment, floodplain soil, and surface water data for Bound Brook, from two channel miles upstream to four channel miles downstream of the former facility, including associated tributaries.



## APPENDIX C: SEDIMENT BROCHURE



3475 East Foothill Boulevard, Pasadena, CA 91107 USA  
+1 (626) 351-4664 | [waste@tetrattech.com](mailto:waste@tetrattech.com)



Providing remedial solutions for contaminated sediment concerns

Tetra Tech's innovative, sustainable solutions help our clients address their water, environment, infrastructure, resource management, and energy challenges. We are proud to be home to leading technical experts in every sector and to use that expertise throughout the project life cycle. Our commitment to safety is ingrained in our culture and at the forefront of every project. We combine the resources of a global, multibillion dollar company with local, client-focused delivery. [tetrattech.com](https://www.tetrattech.com)

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# Practical solutions from initial investigation through design and remediation

Tetra Tech has been in the forefront of the environmental remediation industry since the inception of Superfund and major environmental restoration in the early 1980s. Collaboratively with clients and stakeholders, we develop sediment remediation and restoration strategies for contaminated rivers, streams, lakes, and coastal areas. Our experience includes the remedial design and remediation for sites with a wide range of contaminants, using an array of both active and passive technologies with full design/build capability. In addition, we offer the following advantages:

- **Depth of in-house resources**—risk assessors, geomorphologists, sediment sampling crews, bathymetric surveyors, hydrodynamic modelers, contaminant footprint modelers, design engineers, database experts, and more.
- **Experience**—leading design teams for some of the largest and most complex sediment remediation projects in the U.S. For example, the Fox River project involved removing 3.5 million cy of PCB-impacted sediment in a 13.3-mile river reach, and placement of nearly 600 acres of capping material to remediate another 4.1 million cy of impacted sediment.
- **Full Service**—from initial investigation through design and remediation; preparation of design, specifications, and bid documents; and assistance managing the bid process.



Sediment quality and quantity determine the health and vibrancy of aquatic ecosystems. Unabated by human intervention, the natural and dynamic processes at work by sediment nourish rivers, floodplains, wetlands, deltas, and the biota.



## Site Development Strategies

We collaborate with clients and stakeholders to gain a comprehensive understanding of project goals and objectives, site constraints, and regulatory requirements. Our integrated science and engineering teams then develop cost-effective strategies to address site contamination and limit liability.

- Strategy Development
- Environmental Impact Statements
- Regulatory Assistance
- Risk Management
- Property Transfer
- Natural Resource Damage Assessment



## Site Characterization

Tetra Tech has the in-house staff strategically located nationwide to develop and initiate on-the-ground studies to fully characterize the extent of contamination as the foundation for developing cost-effective alternatives for sediment remediation. Our staffs very experienced in the full range of services needed for sediment remediation projects, which may include any or all of the following:

- Remedial Investigation Studies
- Human Health/Ecological Risk Assessment
- Source Control/Outfall Studies
- Water Quality
- Fluvial Geomorphology
- Hydrodynamic Modeling
- Hydrographic and Geophysical Surveys
- Sediment Quality
- Contaminant Mobility and Sediment Toxicity Testing
- Hydraulic and Sediment Transport Studies
- Marine Structure/Geotechnical Assessments



## Engineering Design

From concept through completion, our multidisciplinary team develops remedial alternatives to address remediation of contaminated sediments. This process includes determining the financial and environmental feasibility of alternative approaches to site remediation.

- Feasibility Analysis
- Remedial Design Plans
- Port/Marine Development
- Pilot Studies
- Dredge Material Handling and Disposal
- Habitat Restoration



## Construction

As a full-service provider, we offer full design/build capabilities that allow us to work cooperatively with our clients from initial assessment through construction.

- Full Design/Build Capabilities
- Constructability Assessments
- Performance Monitoring/Construction Quality Assurance



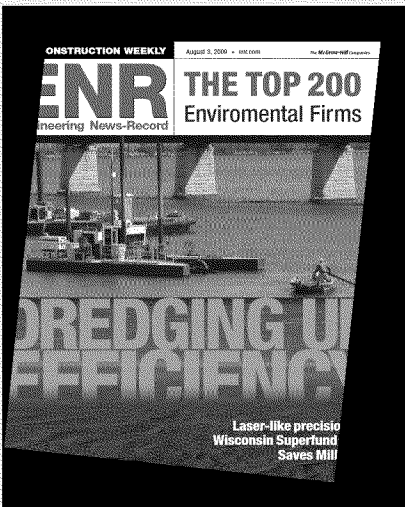
## Site Restoration

We have worked with numerous clients to design and implement post-construction site restoration strategies. Tetra Tech is working with major industrial clients to transform contaminated sediment sites into fully self-sustaining ecosystems.

- Cost Estimates
- Natural Resource Damage Assessment
- Wetlands Assessment
- Habitat Assessment
- Infrastructure Planning and Design

## Quick Facts:

- 250 contaminated sediment management projects nationally and internationally.
- High-profile sediment remediation projects, e.g., Fox River, Middle River, New Bedford Harbor.
- \$2 billion in contaminated sediment work completed or underway in the last 5 years.
- 300 offices worldwide to serve all coastal and inland clients.



Fox River Sediment Remediation project recognized by Engineering News-Record

**“The Fox River cleanup will be the largest PCB river remediation project in the world. Effectively removing PCBs from an active river bed poses many technical challenges. We selected Tetra Tech because of their innovative technical approach, their demonstrated ability to address similar world-class environmental challenges, and their ability to work with the project owners to efficiently manage project costs.”**  
— Christopher Gower, Executive responsible for the Fox River project on behalf of API

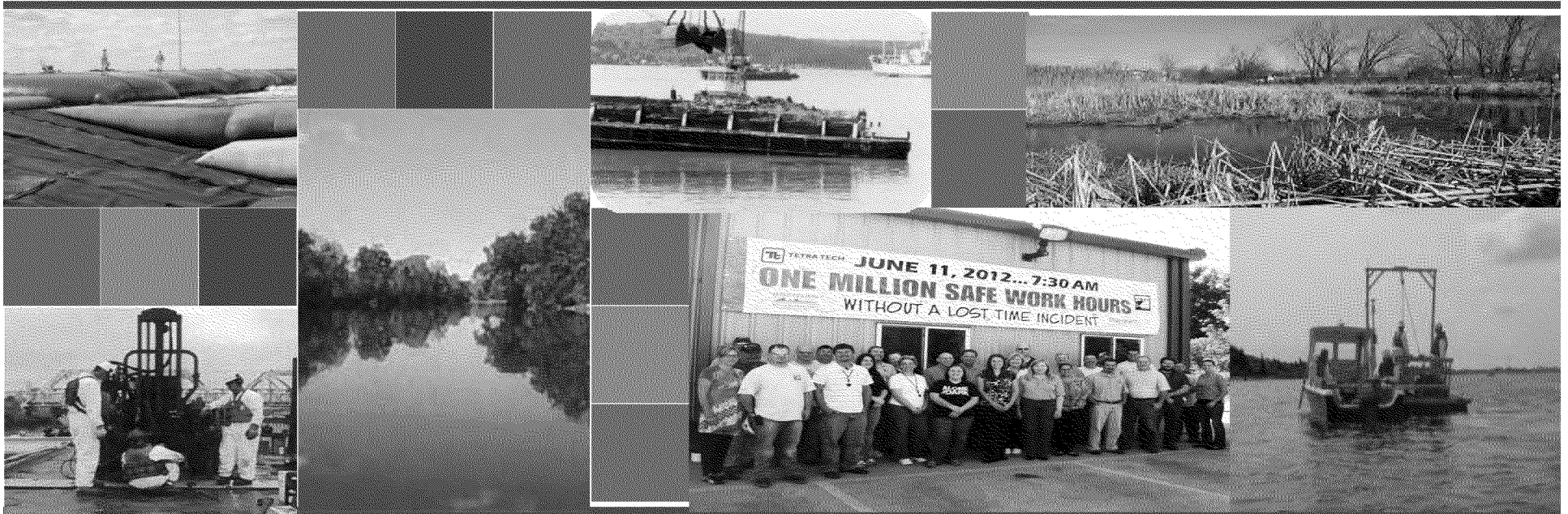


## APPENDIX D: UTC SEDIMENT PRESENTATION



complex world | CLEAR SOLUTIONS™

# Sediment Practice Science, Engineering, Construction



April 23, 2015 Presentation



# Agenda

- Safety Moment
- Introductions
- Tetra Tech Project Experience
- Key Sediment Management Components
  - Hydraulic and Mechanical Dredging
  - Upland Dewatering & Disposal
  - In-Situ Cap Design & Placement
  - Hydrographics
  - Sediment Geostatistics and Modeling
  - Sediment Sampling and Investigations



# Tetra Tech Team

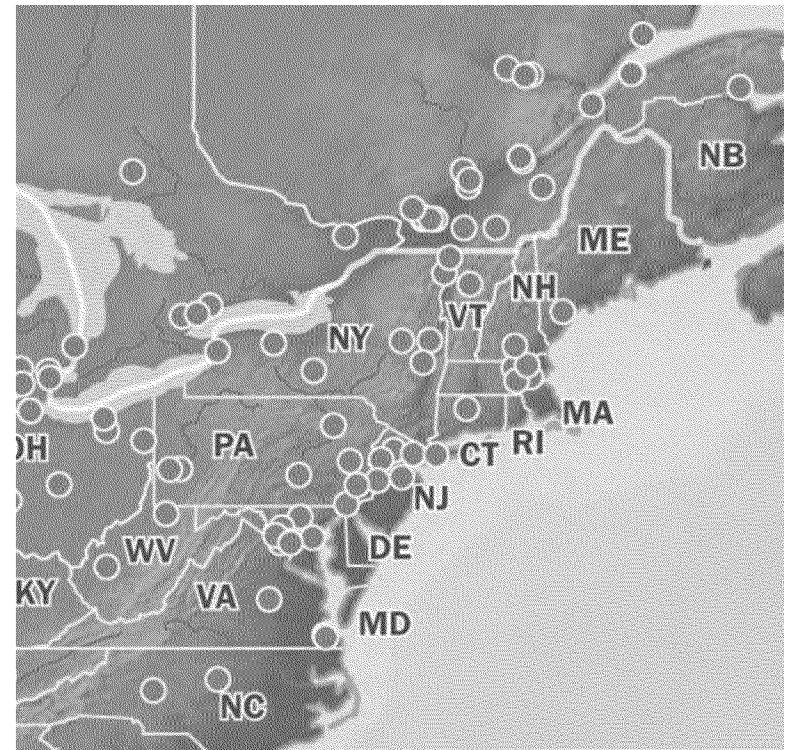
- Scott Parsons
  - Operations Manager
- Mike Noel
  - Principal Hydrogeologist
- Steve McGee
  - Sediment Program Lead
- Gary Braun
  - Western Director Sediment Management
- Robert Judovits
  - Executive Commercial Remediation

# Tetra Tech Team Experience

- Relevant sediment experience on a variety of science, engineering, and construction projects
- CERCLA RI/FS and RD/RA experience
- Excellent reputation with federal and state regulators, and resource agencies
- Sediment Management Work Group (SMWG)
  - 15 year participants
- The power of a billion dollar corporation working at the speed of a 20 person office

# Tetra Tech Team Resources

- Office locations in the northeast
- Personnel have significant sediment experience (Fox, Kalamazoo, Tittabawassee, Ottawa, Grand Calumet and other rivers)



# Relevant Sediment Experience

- Regulatory Negotiation Support of Orders, Scopes, Plans, Closure
- Remedial Investigation, Pre-Design and Engineering Design, Hydrographic Surveying and Mapping
- Construction and Construction Oversight
- Project Examples:
  - Dredging/Construction - Fox River, Middle River
  - Fluvial Geomorphology – H A R, Fox, Tittabawassee
  - Geotextile Dewatering – Kalamazoo River, West Branch Grand Calumet, Ottawa River
  - Cap Design – Fox, West Branch Grand Calumet

# Fox River PCB Sediment Remediation

- 13-mile reach of the river
- 7.5M CY of sediment contaminated PCBs
- Removal of 3.4M CY of PCB-impacted sediment
- Remediation of 4.1M CY of PCB-impacted sediment via placement of 600 acres of engineered cover
- Dewatering and wastewater treatment of  $\approx 7.2$ B gallons

# Examples of Lower Fox River Multibeam Data

- ▮ MBE corrected to NAVD88 with RTK GPS
- ▮ Motion sensor data and sound velocity applied during processing





# Fox River Sediment Removal

3 Hydraulic Dredges, 250 *In-Situ* yd<sup>3</sup>/Hr



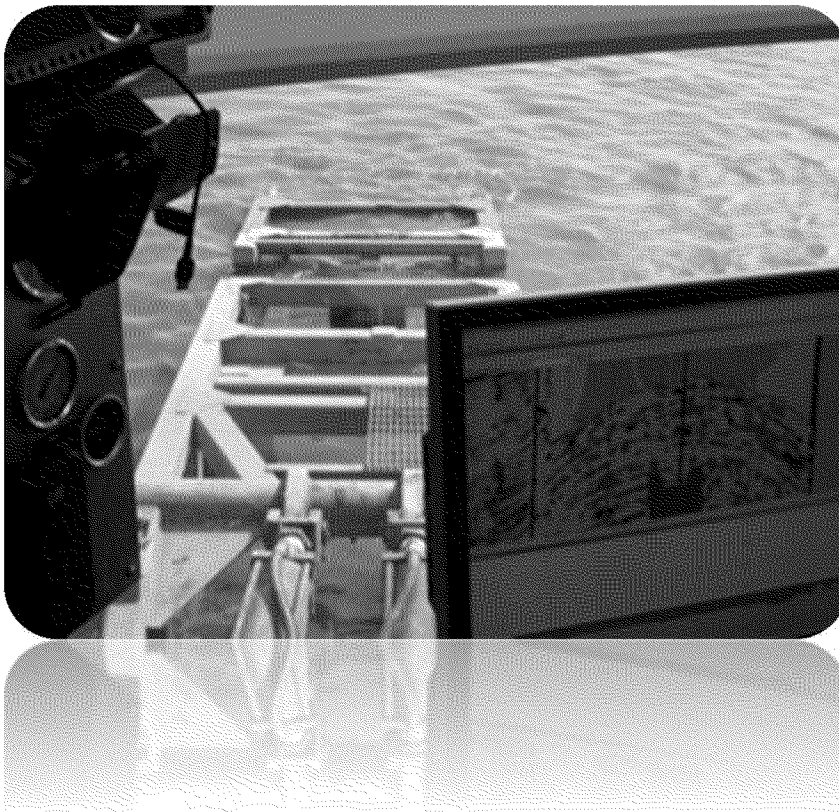
Cutter Head on Articulated Beam



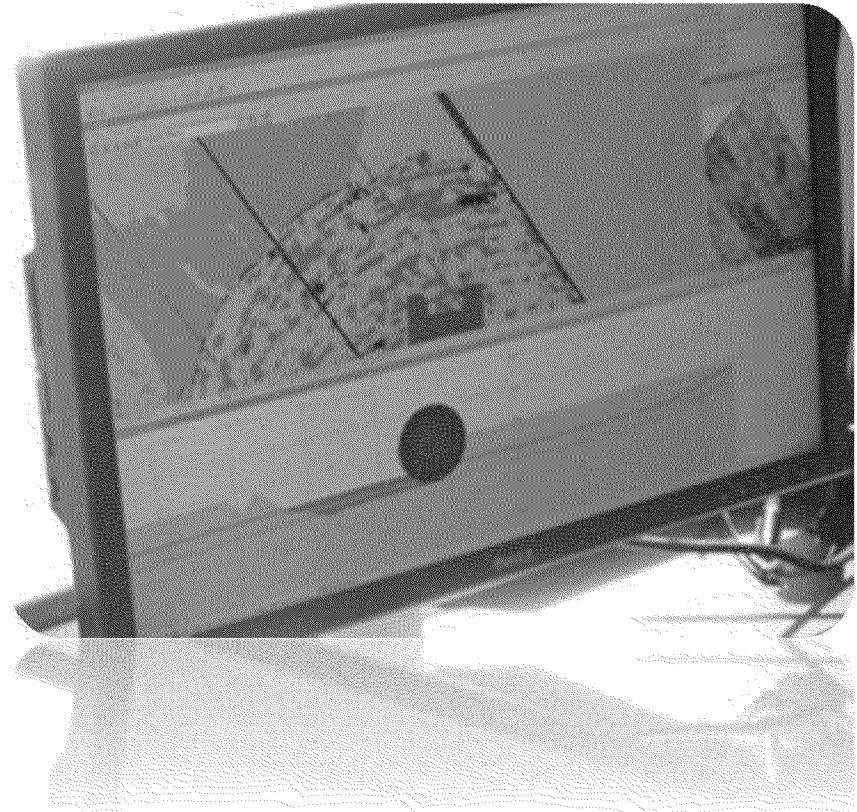


# Fox River Sediment Removal Process Control

Operator View with Heads Up Display

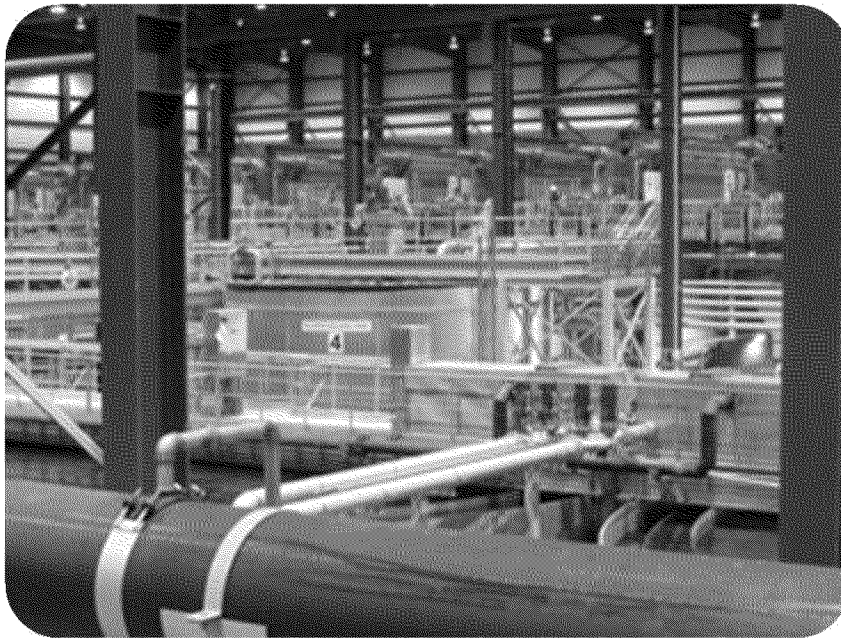


GPS-Controlled Plan & Cross-Section Views



# Fox River Sediment Processing & Sand Removal

**9,000 GPM Facility Capacity**

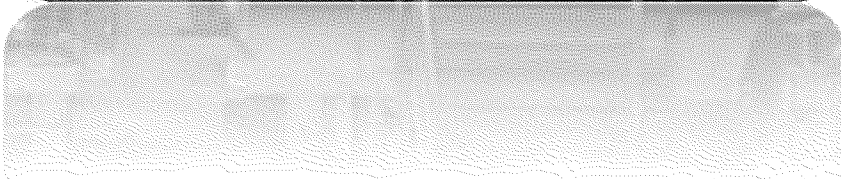


**All Processes Computer Controlled**

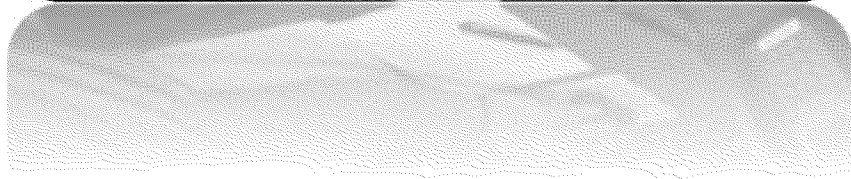
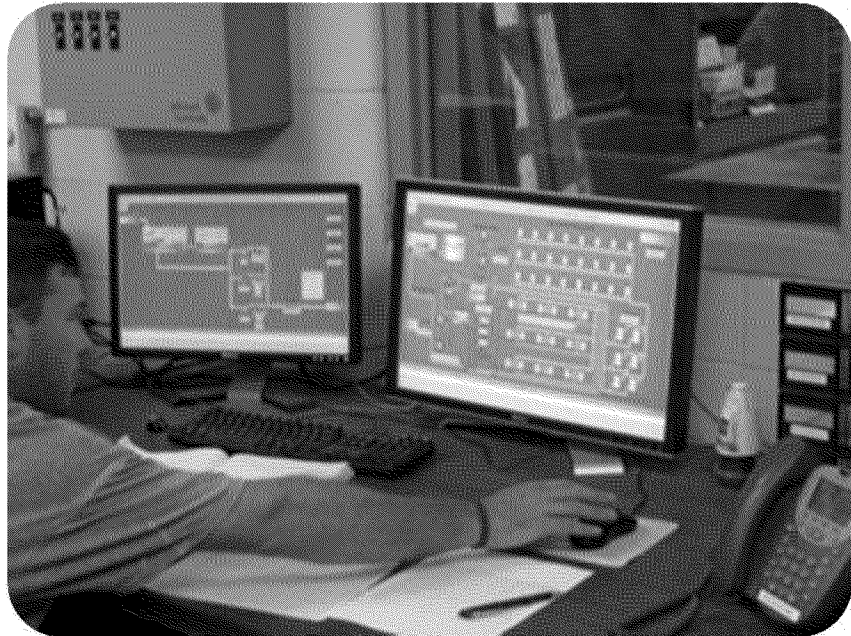


# Fox River Water Treatment

**Bag, Sand & Carbon Filtration Units**



**SCADA System With In-Line ISCO Sampling**





# Fox River Filter Cake Disposal

Filter Cake Storage & Processing



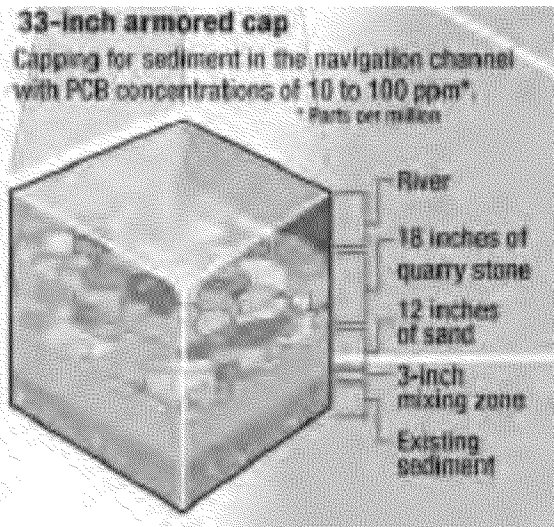
80-110 Truck Loads per Day to Landfill



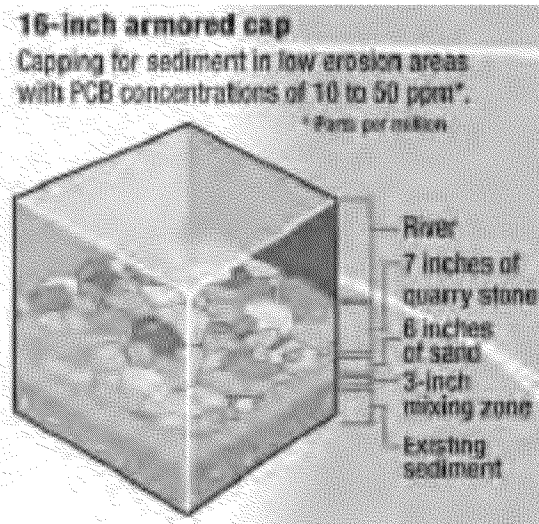
# Fox River

## Contaminated Sediment Capping

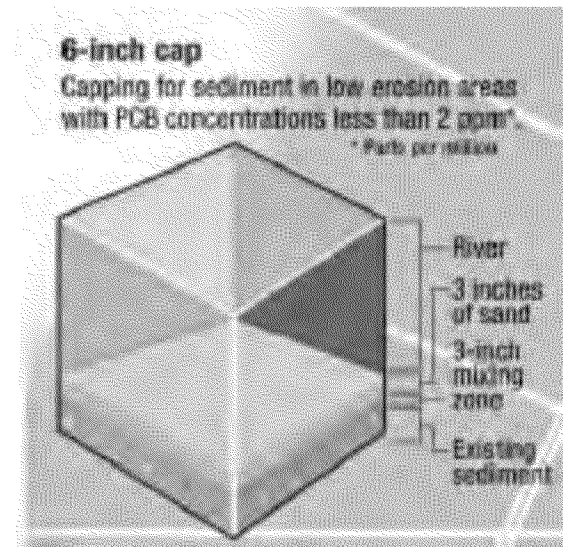
**33-inch Armored Cap**  
Navigation Channel  
PCBs 10-100 ppm



**16-inch Armored cap**  
Low Erosion Area  
PCBs 10-50 ppm



**6-inch Cap**  
Low Erosion Areas  
PCBs < 2 ppm



# Middle River, MD Dredging Project





# Middle River, MD Dredging Project

- Sediment Removal Action (SRA)
- RI/FS/RD Prior Work
- 5300 CY Dredge & Stabilize RA Project
- TSCA Removal Action
- EPA Region III and MDE
- Winter Season Challenges



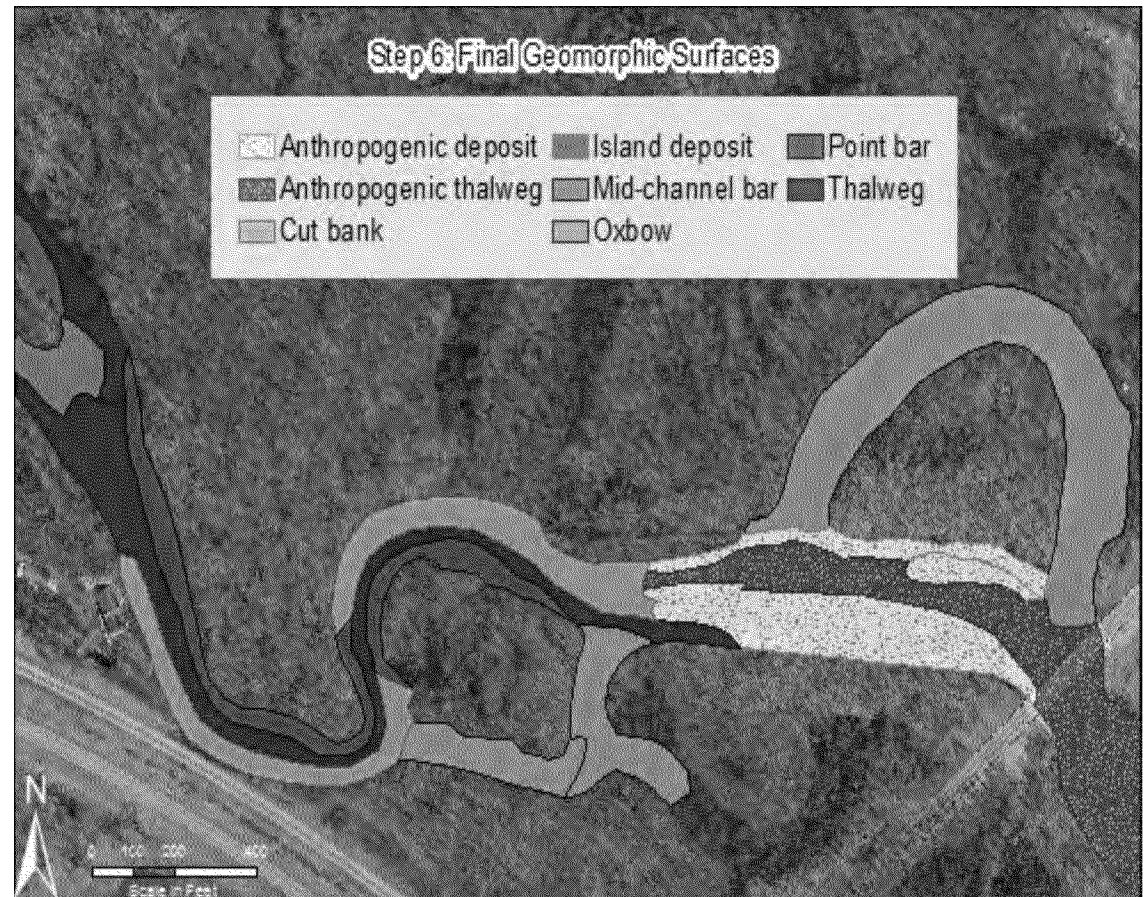
# Middle River, MD Dredging Project





# Fluvial Geomorphology - Investigations

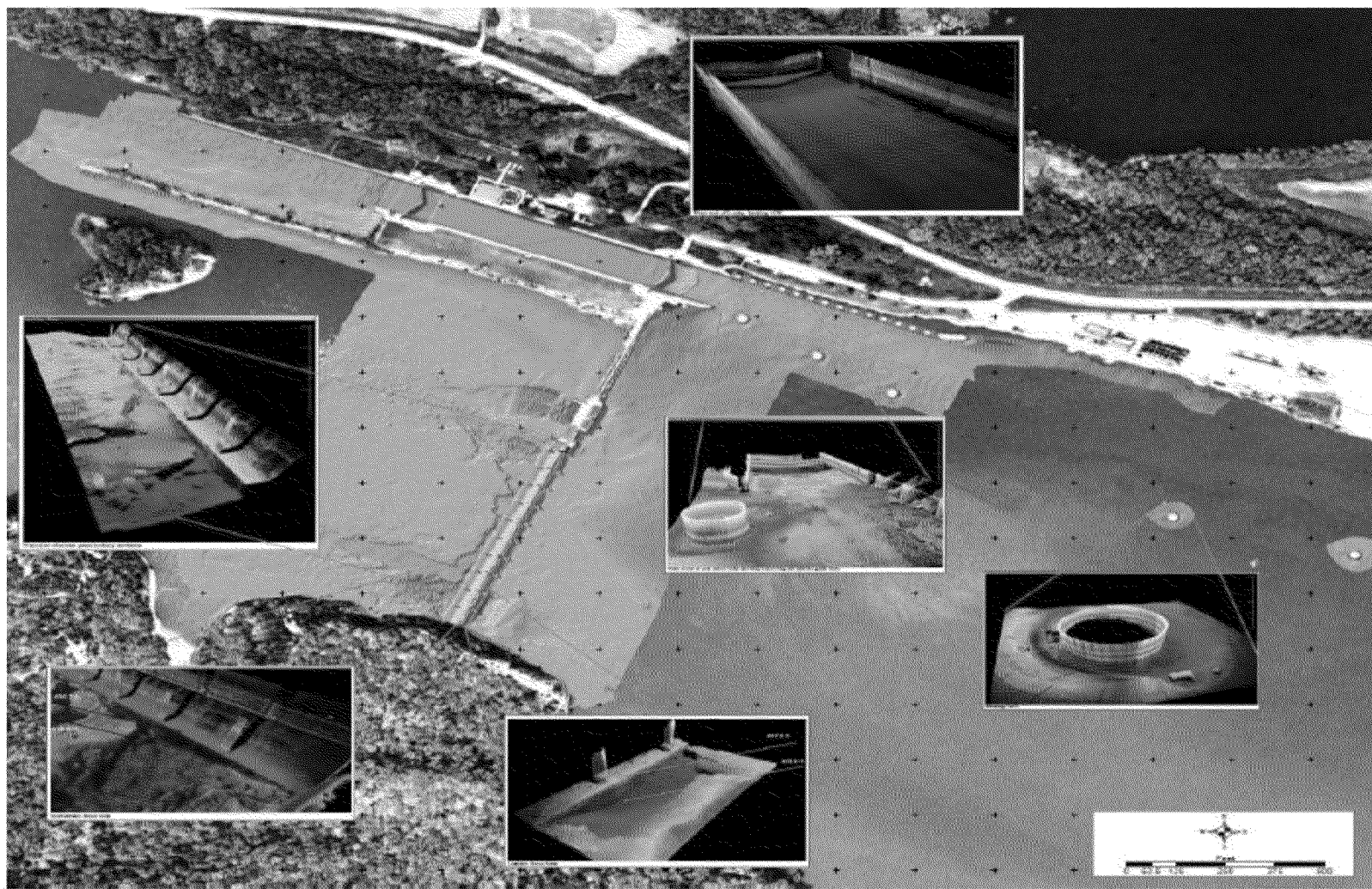
- Scientific study of formation, evolution, and function of fluvial systems
- Focus on understanding river systems in both natural and human-impacted settings



# Multiple Lines of Evidence

- Multiple methods used to develop channel and overbank geomorphic surfaces:
  - Desktop analysis using leaf-off aerial photographs
  - Contour elevations for overbank surfaces
  - Channel longitudinal profile
  - Soil survey data for overbank surfaces
  - Geomorphic fluvial setting
  - Sediment and/or soil type and profile characterization
  - Channel width
  - Water depth
  - Anthropogenic impacts (e.g. dams, bridges)
- Surfaces used to determine erosional/depositional areas

# Bathymetry Maps

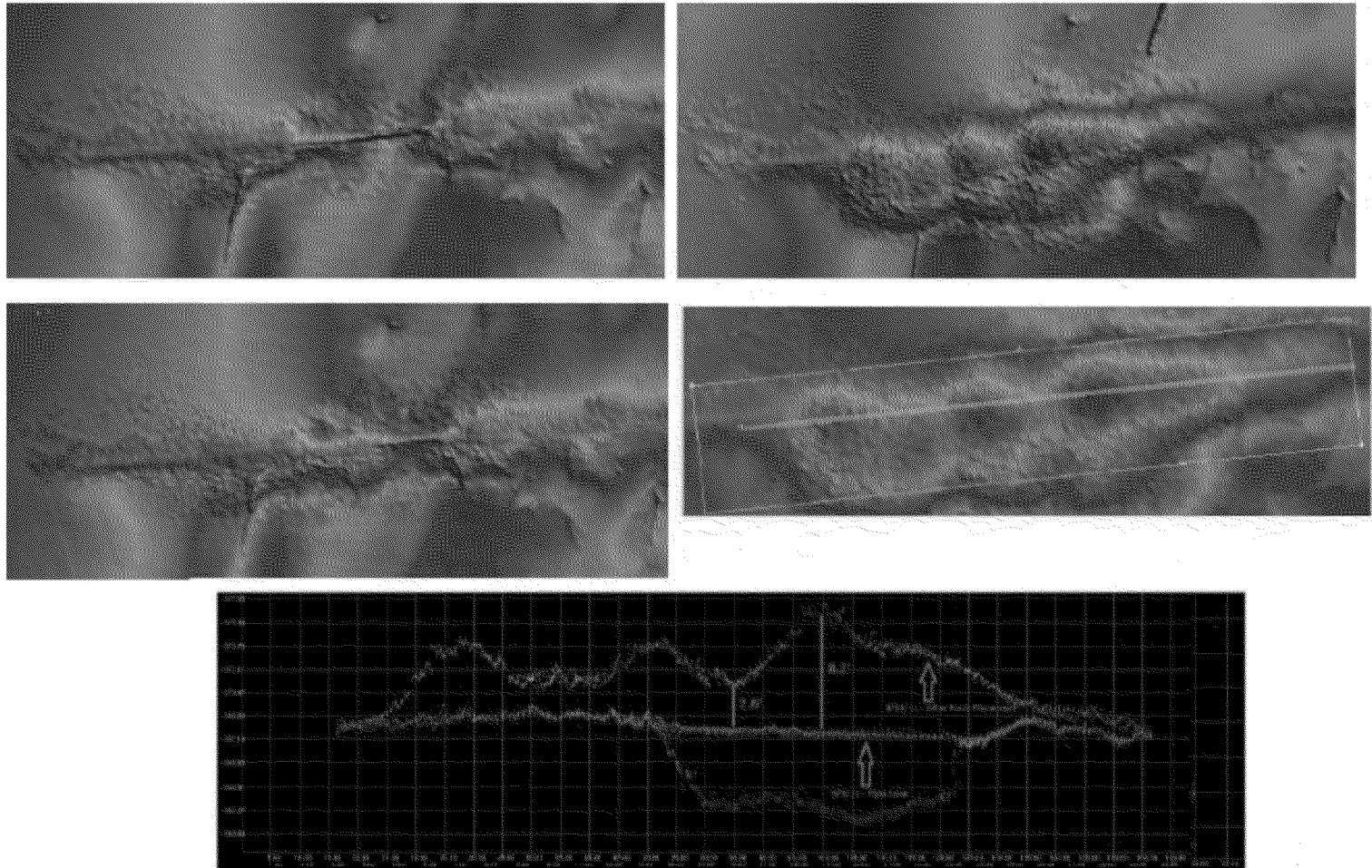






TETRA TECH

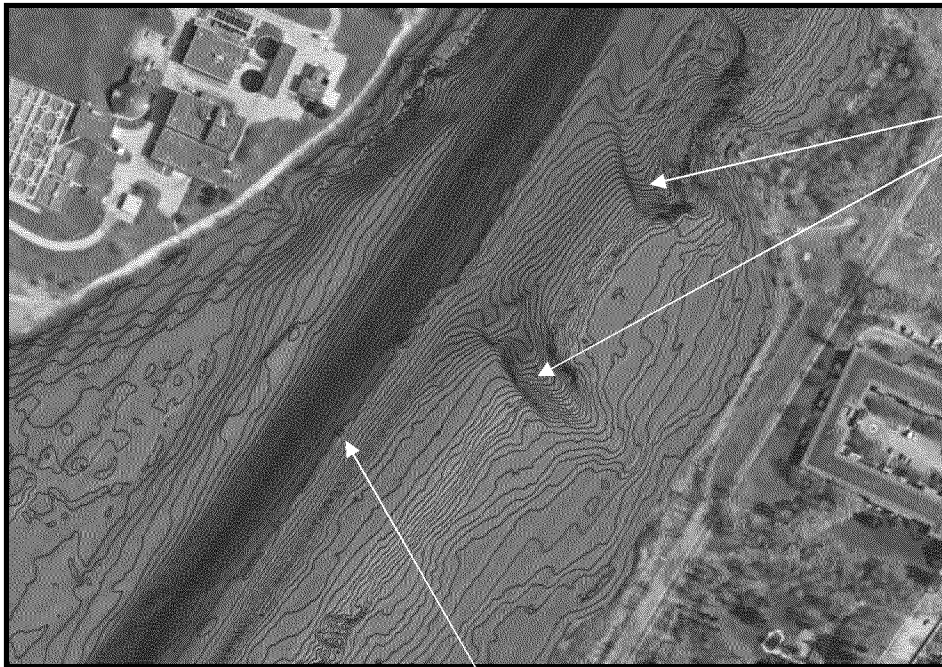
# Bathymetry Maps – Oil Pipeline





TETRA TECH

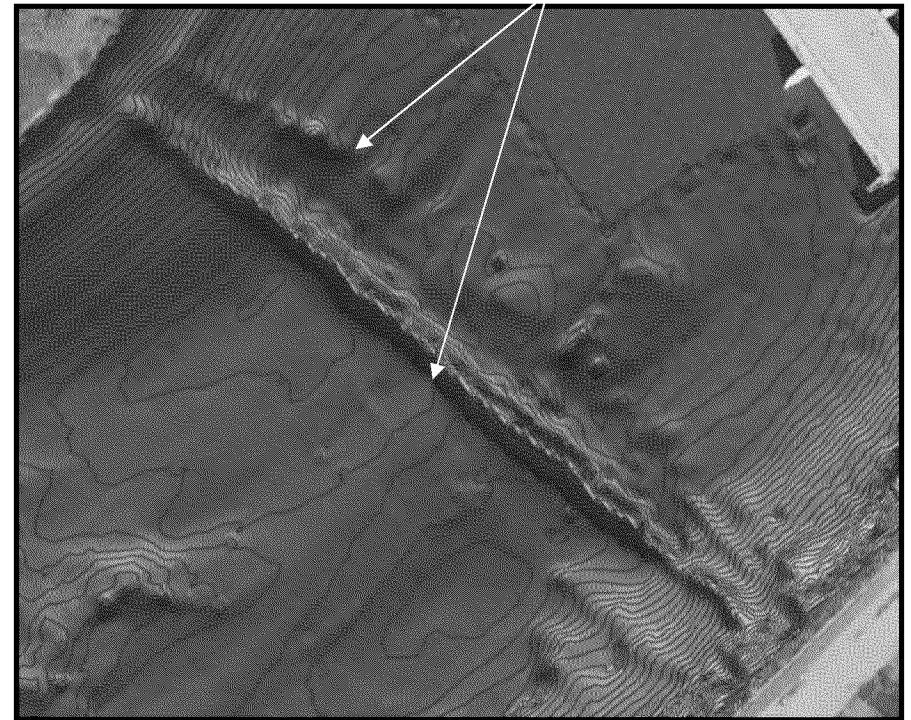
# Anthropogenic Features



Outfalls

Unburied utilities

Dredged navigation channels





TETRA TECH

# Geomorphic Surface Mapping



TETRA TECH

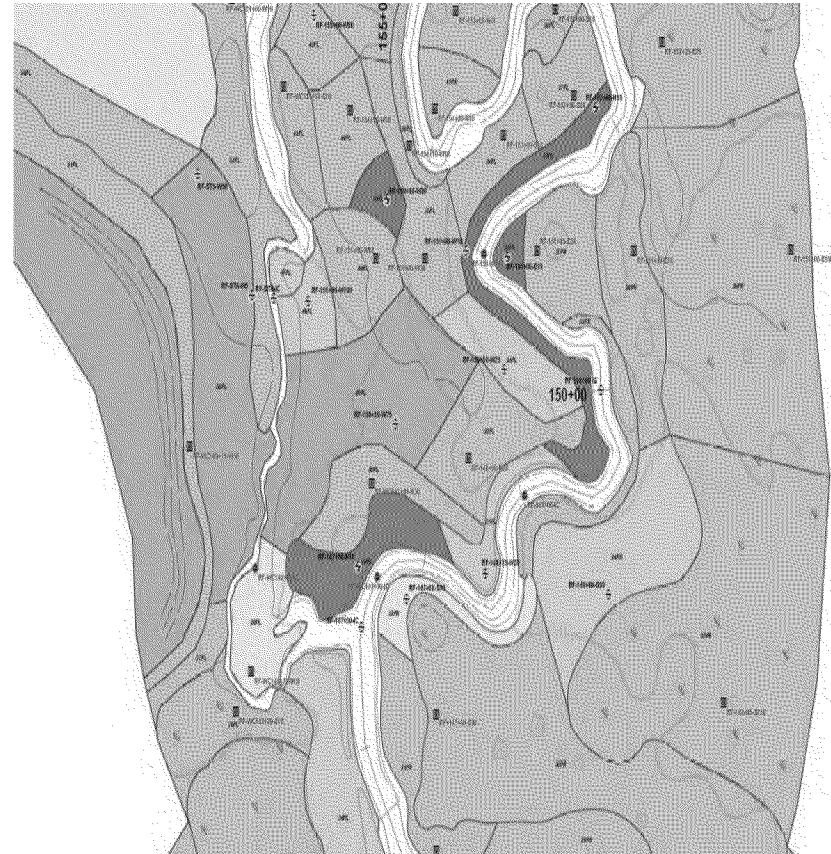


# Hayton Area Remediation Project

**Geospatial Approach:**  
25,700 cubic yards; \$5.2 Million



**Geomorphic Approach:**  
5,700 cubic yards; \$2.3 Million



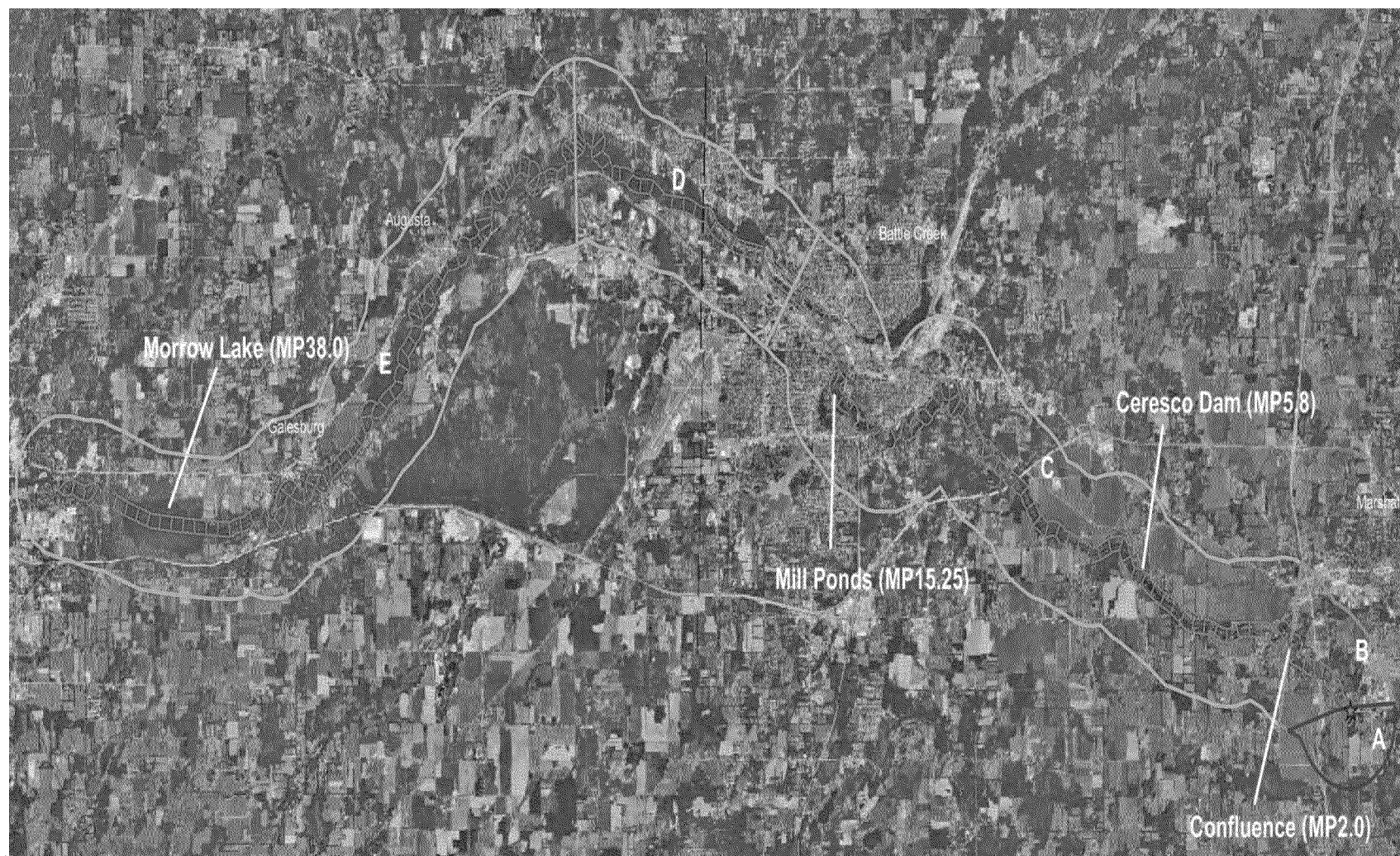
## Application of Geomorphology

- 
- 2010 Infill Results: SHC 11 and D23 North**
- Historical Locations**
- Location ID
- Maximum PCB Concentration (ppm)
- < 0.50 • 2.00 - 5.99  
 • 0.50 - 0.99 • 6.00 - 9.99  
 • 1.00 - 1.99 • 10.00 +
- Remediation Zones**
- C04 Cap A Areas (100% Design)  
 • C04 Cap B Areas (100% Design)  
 • C04 Cap C Areas (100% Design)  
 • C04 Design Areas (100% Design)  
 • C04 Sand Cover Areas (100% Design)  
 • C04 Shoreline Cap Areas (100% Design)  
 • C04 Sloped Shoreline Cap Areas (100% Design)
- Proposed Changes to Remediation Zones**
- Alternative RA  
☒ No Action
- 2010 Infill Locations**
- G04 Location • S04 Location • P04 Location  
 • C04 Location • S04 Location • P04 Location
- Other Features**
- Bathymetric contours (half-foot)  
 • Modern-based Navigation Corridor
- Shaded Channel Bed Relief**
- Elevation  
 High - 550.275  
 Low - 535.990
- Scale**
- 0 60 120 180 Feet  
 1 inch = 80 feet
- North Arrow**
- TETRA TECH**
- Fox River, Wisconsin, 12/07/2010**



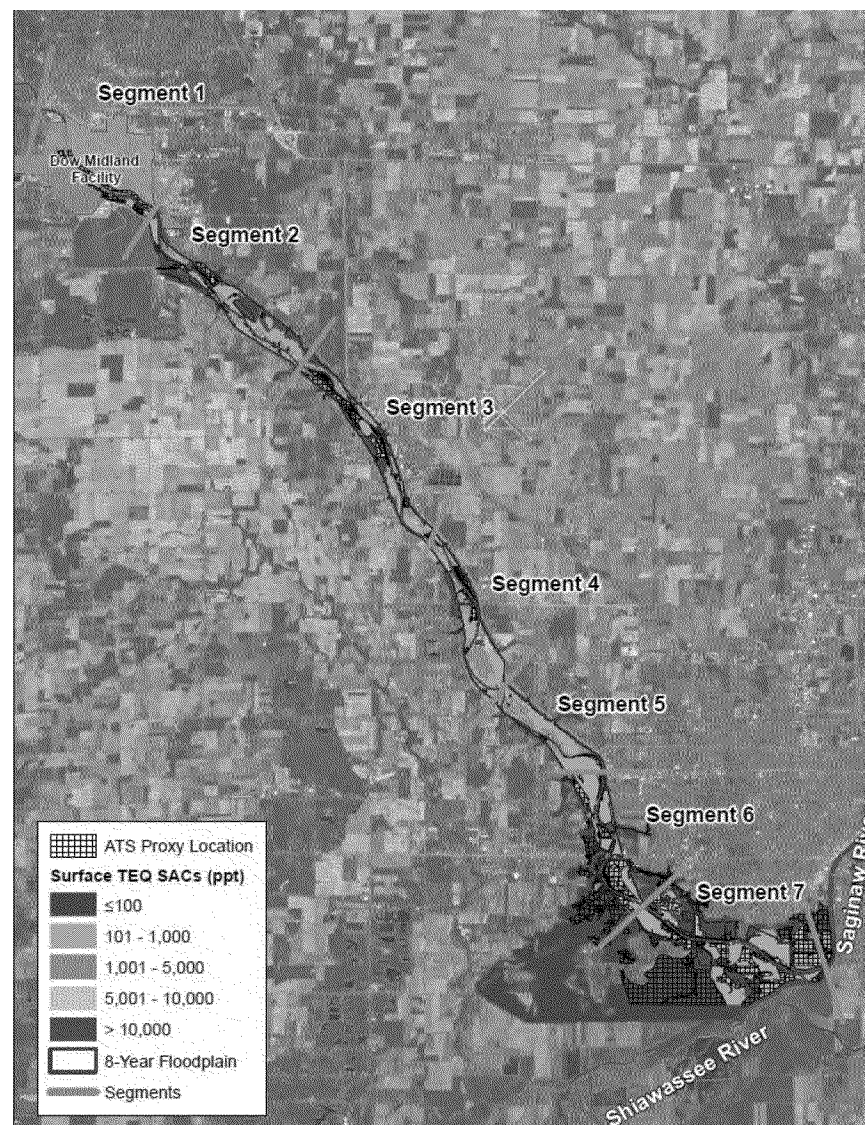
# River Emergency Response

2 week desktop study identified 35 primary deposition areas over 40 mile river reach



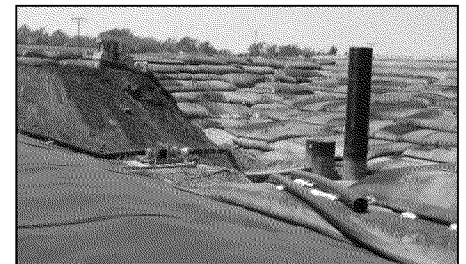
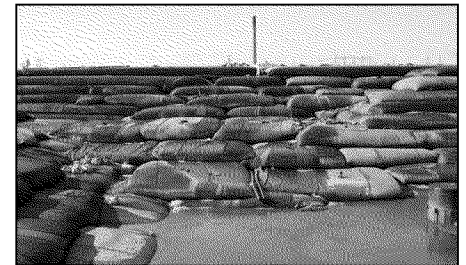
# Tittabawassee River & Floodplain RI

- 24 River Miles
- 8,000 Acre Floodplain
- 4,518 Sample Locations
- 75% Reduction for Locations over EPA Mega Rule
- Analytical Cost Savings Offset Entire RI Cost



# Geotextile Tube Dewatering Experience

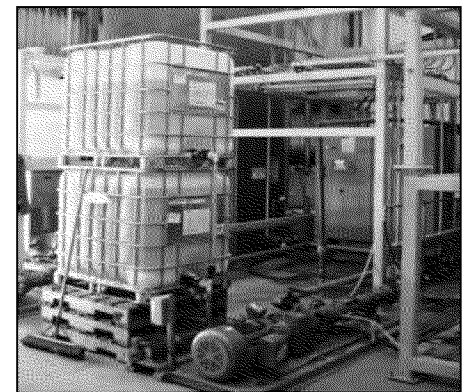
- Hydraulic dredging to geotextile tubes experience unmatched in the industry
- 4 million yds<sup>3</sup> of contaminated sediments dewatered
- 1,000,000 lineal ft of geotextile tubes deployed
- Large scale applications processing flows up to 5500 gpm
- Tube sizes up to 400 ft length, 120 ft circumference
- Stacked tubes up to 10 layers



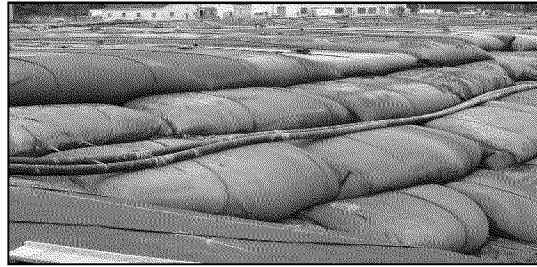


# Keys to Successful Dewatering

- Large circumference geotextile tubes
- Circumferential seams for strength & stability
- Scalping off excessive carriage water and pre-thickening sediment slurry
- Dewatering area drainage
- Debris management in the header system
- Polymer optimization
- Safety of dewatering crews



# Stacking Strategy



- No stacking before material in tubes reaches in-situ percent solids
- Place tubes as closely together as possible
- Stacked tubes centered over the seam between the two supporting tubes
- Each consecutive layer of tubes shorter in length than the layer below
- First tubes filled are those at lowest elevation in each layer



# Ceresco Dam Dredging Project

- EPA required dredging at Ceresco Dam
  - Largest depositional area 6 miles from release
  - Poling identified large volume of submerged oil
  - EPA not yet convinced of efficacy of tool box techniques
- EPA concerned about September 27 deadline
  - Notice letter deadline extended to October 31
  - Dredging schedule of 30 days negotiated
  - Approval provided from EPA headquarters



Configuration of  
dredge area to  
dewatering pad

3 dredges working  
concurrently at 1200 gpm



# Ceresco Dam Project Approach

- Hydraulic dredging selected
  - Low draft requires specialized equipment
  - One foot cut including overdredge allowance
- Geotextile Tubes for Dewatering
  - Bench scale results favorable
- Water treatment system design finalized
- Dredging endpoints negotiated with EPA
- Monitoring program negotiated with EPA
  - Presented at public meetings



# Hydraulic Dredge—Amphibex

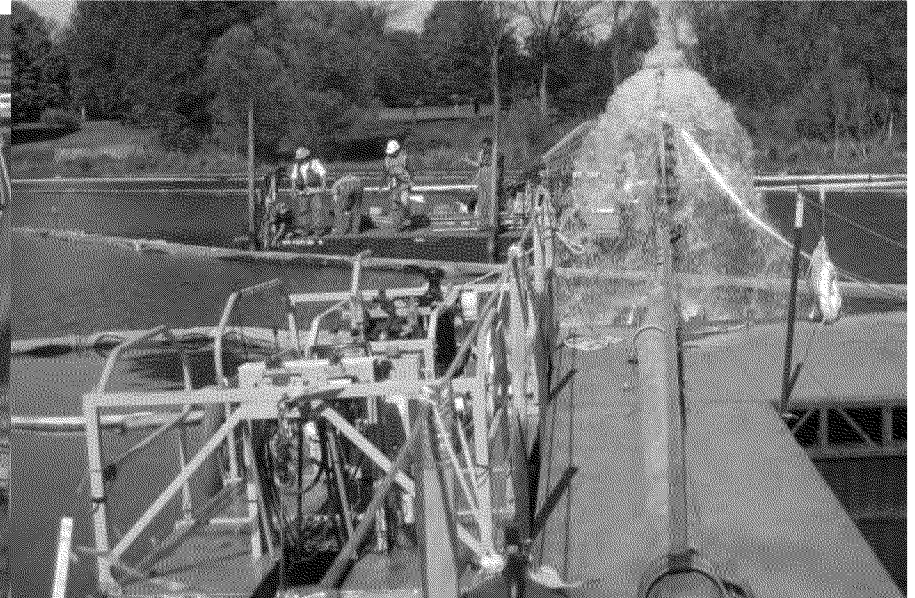




# Hydraulic Dredge—Horizontal Cutter Head



Diffuser pipe above water discharge



Flocculant dosage rate of 2 ½ lb per dry ton  
ton and coagulant of 0.5 lb per dry ton











75,000 gallon weep  
water collection sump



#### Legend

-  Priority Areas
-  Dredging Cell
-  Dredging Complete
-  Dredging In-Progress

**Dredging Complete  
Through 10/16/10:**  
 5.75 Northwest: 1.5%  
 5.75 South: 80%  
 5.63 South: 13%

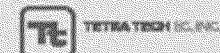
**Treated Water Discharge:**  
 816,000 Gallons on 10/16/10



1 inch = 90 feet

Coordinate System: Michigan State Plane South  
 Horizontal Datum: NAD83  
 Vertical Datum: NAVD83  
 Units: International Feet

**DREDGING PROGRESS MAP  
 CERESCO DAM  
 SUBMERGED OIL TASK FORCE  
 CERESCO, MICHIGAN  
 October 16, 2010**



10/16/10 - G. Cipollone



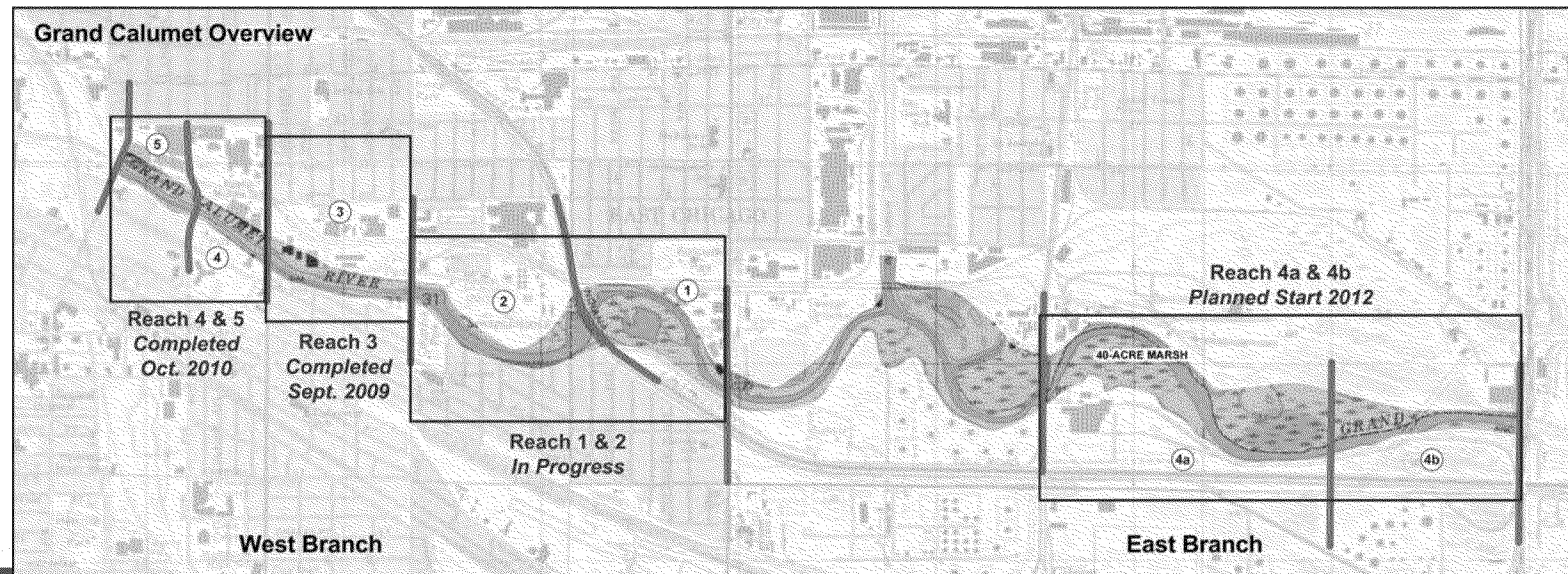
# Filter Cake Loadout





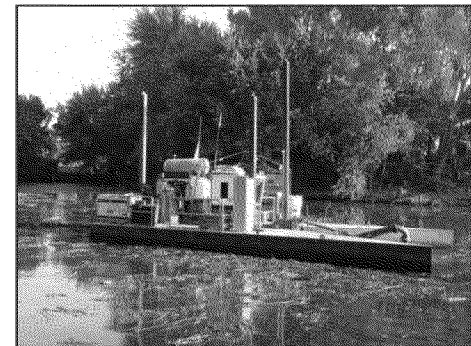
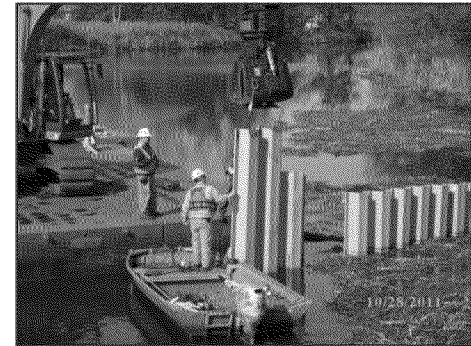
# West Branch Grand Calumet River Sediment Remediation

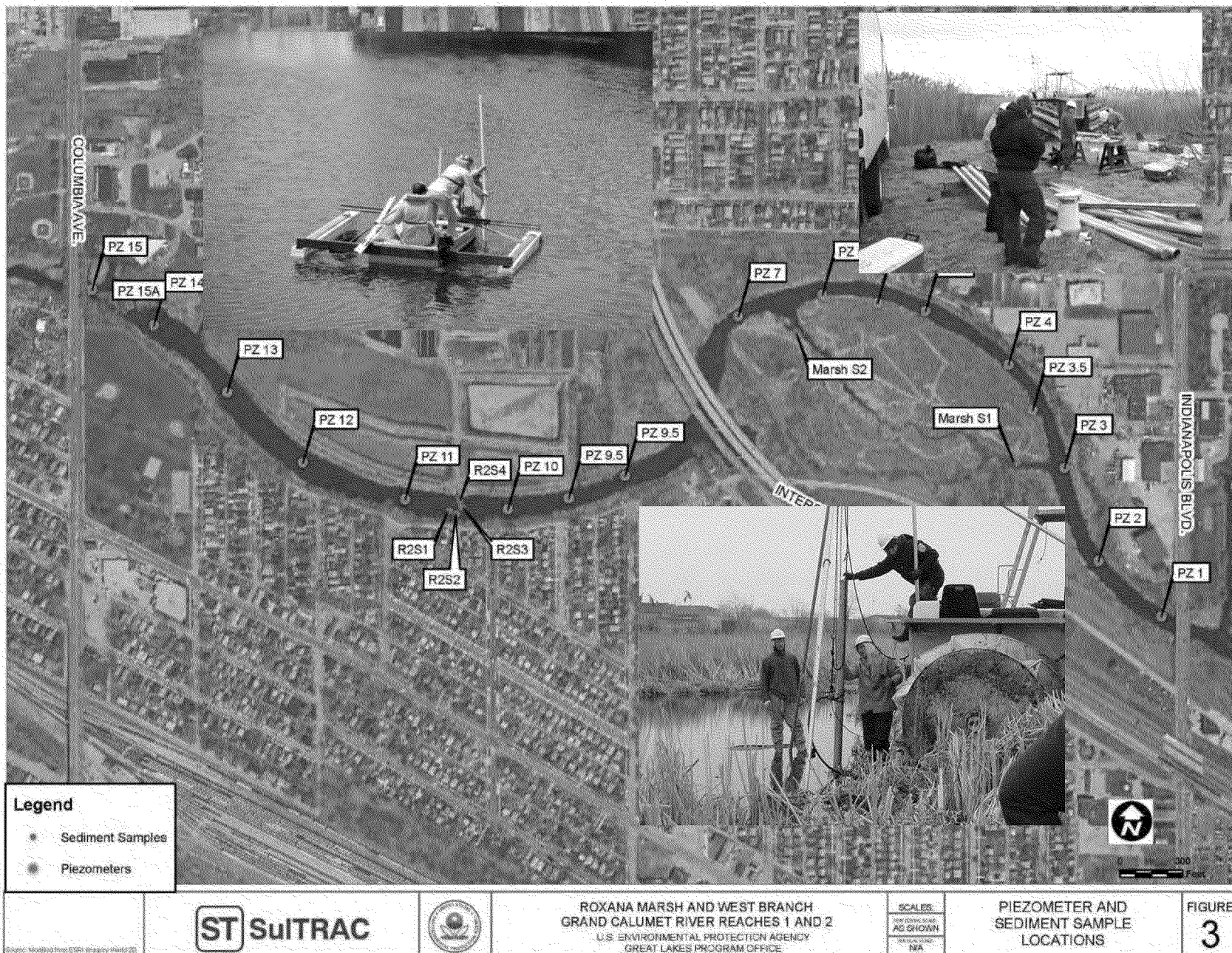
- Great Lakes Legacy Act project
- EPA GLNPO, FWS and State of Indiana
- Grand Calumet River AOC, Lake County, IN



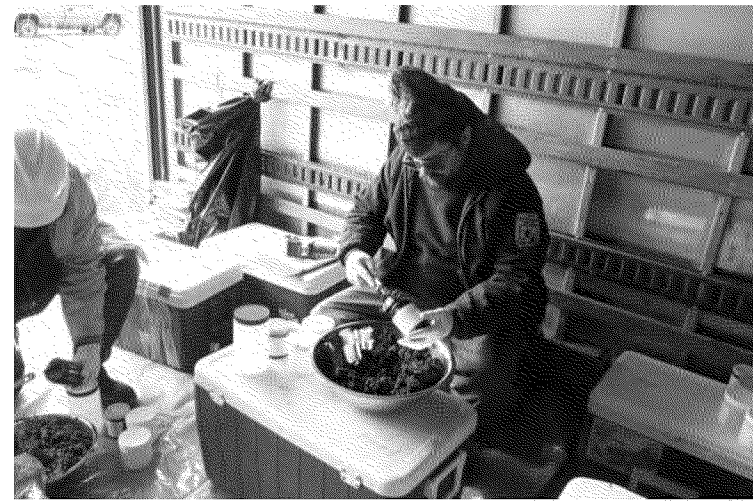
# Site / Project Involvement

- Site Investigation from the 1990's
- Tetra Tech Characterization Report 2003
- Tetra Tech Restoration Options Report 2006
- Tetra Tech/SulTRAC Reach Designs 2008 – 2012
- SulTRAC Project Implementation
  - Reach 3 – 2009/10
  - Reaches 4 & 5 – 2010/11
  - Reaches 1 & 2 and Roxana Marsh Restoration – 2011/12

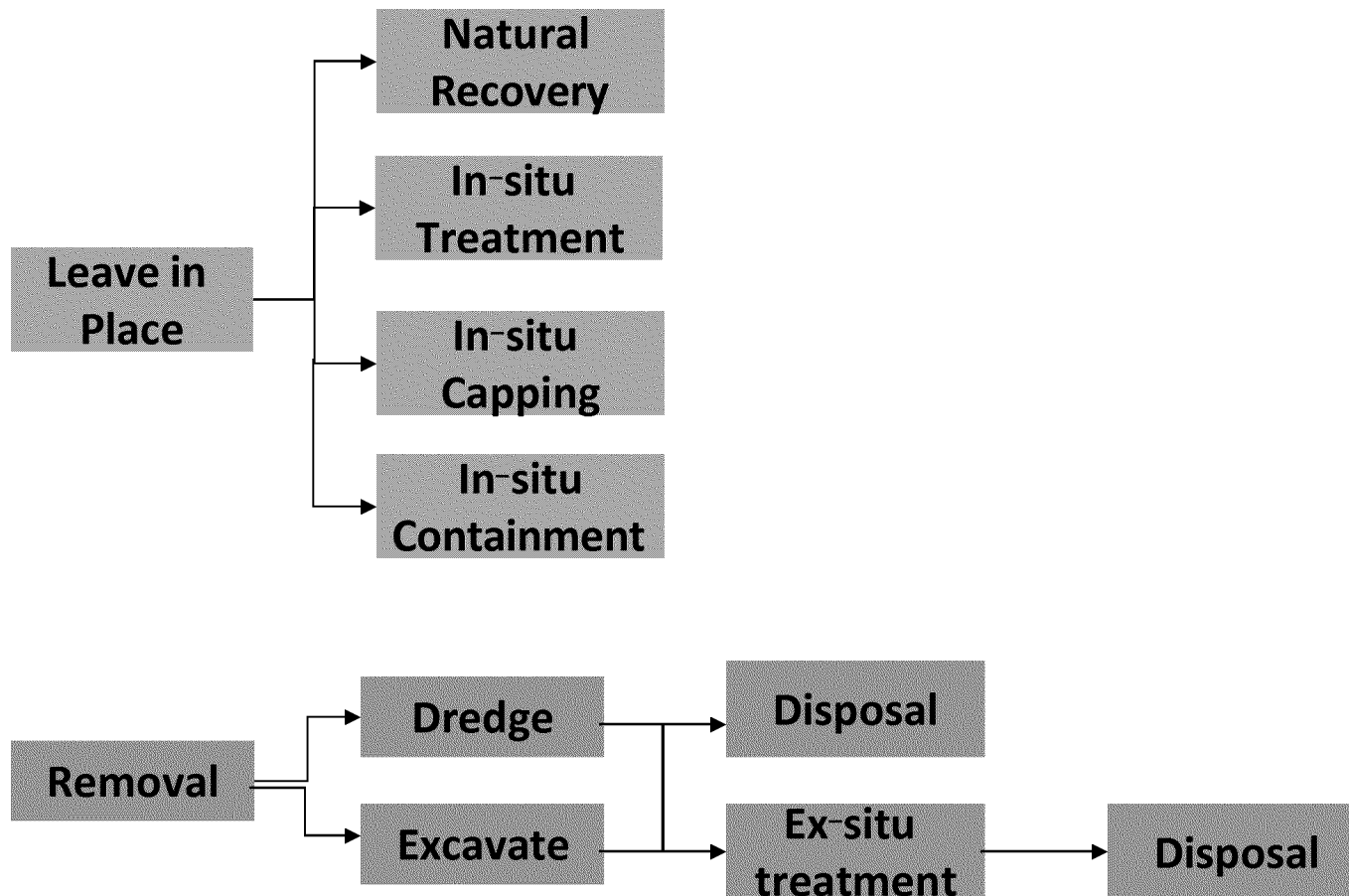








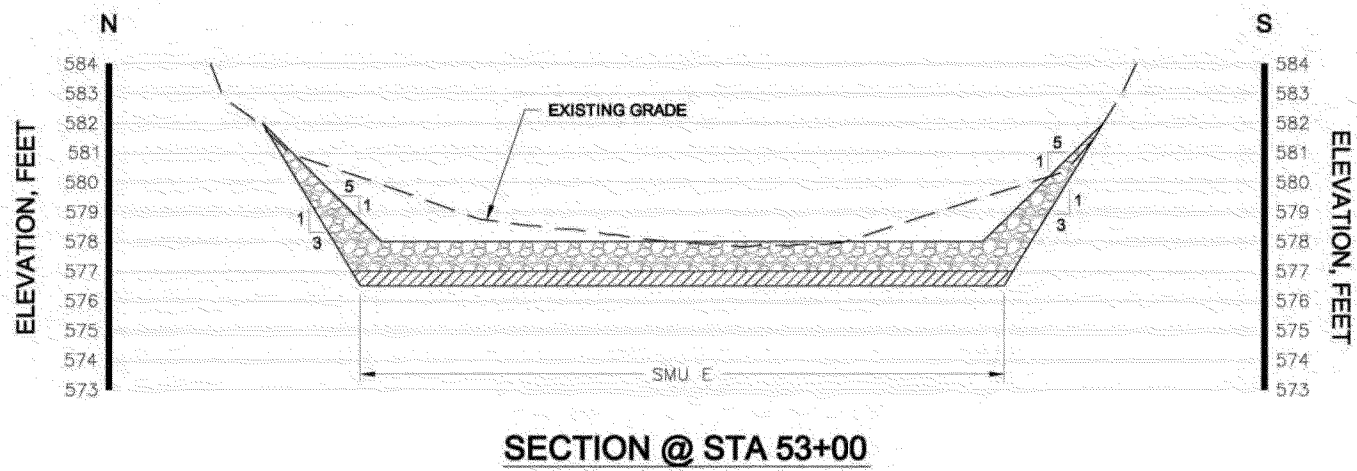
# Sediment Restoration Alternatives





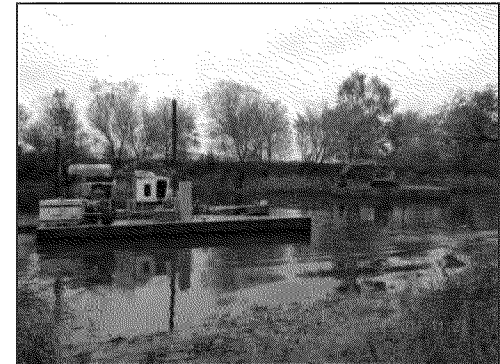
# Cap Design

- Reible model
- Adsorptive Layer: 6-inch layer of organoclay and granular material
- Organoclay Loading: 2.49 lbs/cf
- Protective Layer: 12-inch granular material, min 10.5 inches thick over Adsorptive layer
- Armor Layer: 6-12 inch material at outfalls



# Project Components

- Hydraulic Dredging
- Dewatering/Water Treatment
- Disposal
- Capping
- Marsh Remediation/Restoration



# Hydraulic Dredging



- 12 hrs/day, 6 days/week
- 2 x 8-inch dredges



# Sediment Dewatering Operation





# Cap Placement (Water Side)





# Marsh Excavation Progress



# Before and After



# Client Focused Solutions

- Excellent Safety Record
  - Experience Modification Rate (EMR) of 0.80
- Entire Project Life-Cycle Service Line
- Specialized Sediment Expertise
  - Hydrographics
  - Fluvial Geomorphology
  - Engineering Cap Design
  - Construction Dewatering



## APPENDIX E: SEDIMENT SERVICES SOQ

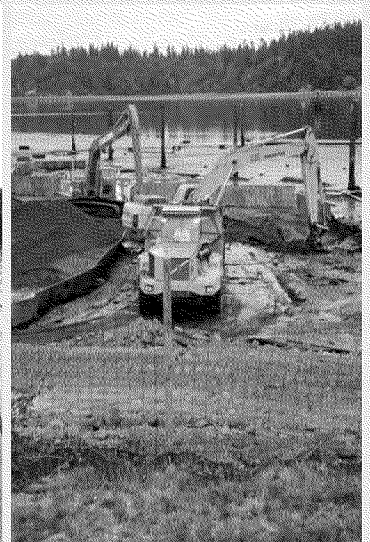




TETRA TECH

## Statement of Qualifications

# Sediment Services





As a full-service consulting, engineering, remediation and restoration company, Tetra Tech has experience with the full range of sediment management solutions, including innovative approaches which have saved clients millions of dollars. Sediment remediation strategies range from passive approaches for areas with low levels of contamination, to more active approaches for areas that exhibit higher levels of contamination.

We have successfully developed strategies for both mechanical and hydraulic dredging technologies that best meet the needs of the client for the particular application. With the ability to draw upon our in-house bathymetry team, we can assure our clients of accurate volume estimations and minimized costs associated with potential over dredging, while ensuring we meet the project objectives. The use of this team with in-house bathymetry capability further ensures that placement of cap material is in accordance with design specifications.

## Practical Approaches

A practical sediment management program can enhance the value of waterfront property and mitigate liability to facility owners and operators. Whether responding to agency pressures or planning to purchase or redevelop shoreline areas, clients turn to Tetra Tech to unlock the full value of waterfront properties and facilities.

We help clients establish comprehensive sediment management strategies, integrating facility planning and development with remedial activities in order to optimize every dollar.

Our sediment management and waterfront development specialists focus on providing cost-effective and practical solutions to clients concerned with waterfront areas, such as:

- ☐ Ports and harbors
- ☐ Industrial sites and "Brownfields"
- ☐ Marinas
- ☐ Container and ferry terminals
- ☐ Rivers and streams
- ☐ Estuaries
- ☐ Lakes

## Services

### Sediment Management Strategies

- Strategic project management
- Coastal and waterway engineering
- Dredge design and permitting
- Sediment management
- Industrial siting
- Site investigations and remediation
- Environmental impact assessments
- Water quality and stormwater management
- Point and non-point source control
- Decision analysis
- Resource economics
- Wetland planning and development

### Regulatory Compliance and Permitting

- ☐ Regulatory advocacy
- ROD development and re-negotiation
- Regulatory negotiation

### Innovative Approaches to Remediation

- ☐ Integrated sediment management and waterfront permit strategy development
- ☐ Upland versus confined aquatic disposal options

### Resource Surveys, Assessments, and Plans

- ☐ Wetland and water resources
- ☐ Threatened and Endangered Species—fish and wildlife
- ☐ Cultural resources

### Risk-Based Approaches

- Human health and ecological risk assessments
- ☐ Ecological risk assessments
- ☐ Human health risk assessments
- ☐ Strategic environmental management
- ☐ Risk management
- ☐ Toxicology
- ☐ Risk-based corrective action (RBCA)
- ☐ Natural resource damage assessment
- ☐ Habitat design

### Additional Support Services

- ☐ GIS Applications
- ☐ Public Involvement

## PERFORMANCE HIGHLIGHTS

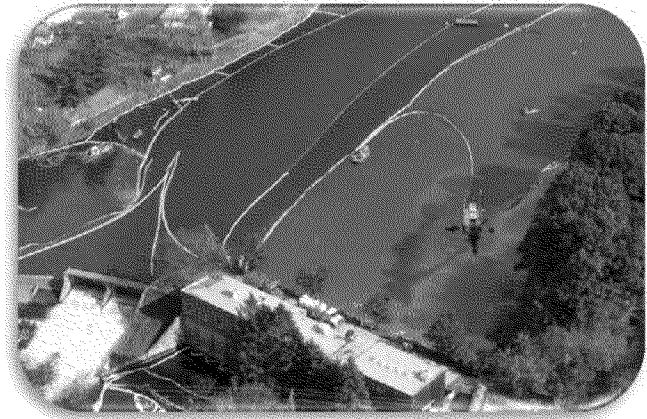
Tetra Tech successfully performed more than 250 sediment management projects nationally ranging from small to large projects.

Currently overseeing all aspects for dredging of 3.5 million cy of PCB-impacted sediment for a 13-mile reach of the Lower Fox River, including placement of nearly 600 acres of capping material and Phase I facility construction and startup for this 9-year, \$700 million design-build project.

Established relationships with dredge contractors nationwide.

Ability to rapidly mobilize and begin cleanup actions due to nationwide staffing, as demonstrated by Tetra Tech's support for the Enbridge Kalamazoo River oil spill.

Strategically located offices nationwide with staff and expertise to support a broad range of sediment management issues.



Tetra Tech, Inc. is a publicly traded company with annual revenues in excess of \$2.7 billion and more than 14,500 employees in 330 offices throughout the world.

## Sediment Management Strategies

Tetra Tech understands the unique challenges faced by waterfront owners and operators. At a time of stiff global competition, lending institutions and regulators increasingly require thorough, defensible environmental and dredging strategies before approving development plans.

To assist our clients with development or purchase plans, Tetra Tech helps develop comprehensive sediment management strategies which respond to ecological and human health concerns, and which account for the disposal of dredge materials. The goal of any strategy we develop is to save money and limit liability for our clients, while managing environmental issues in a responsible and technically defensible manner. To achieve this goal, effective strategies should integrate the following:

- ☐ Evaluation of technical and regulatory issues;
- ☐ An understanding of financial institution requirements and policies;
- ☐ A conceptual model for future development and site use needs; and
- ☐ Innovative approaches to contaminated sediment cleanup and disposal.

## Technical and Regulatory Drivers

Because our regulatory specialists carefully track state and federal environmental legislation, Tetra Tech's clients can anticipate and plan ahead for regulatory changes that may affect waterfront planning and development. Many of our scientists and engineers belong to advisory boards and technical committees set up to advise law makers on environmental rule making.

As an example, our Pacific Northwest staff have worked extensively with the Washington State Department of Ecology Sediment Management Standards, the nation's first regulatory program specifically designed for contaminated sediments. They also participated in the review of the USEPA contaminated sediment management strategy and the Puget Sound Estuarine Program protocols for the characterization of contaminated sediments, considered to be among the most progressive guidelines in the country. Tetra Tech routinely conducts projects governed by CERCLA, RCRA, NPDES, CWA, and numerous other federal, state, and local regulations.

We use our extensive knowledge of regulatory and technical drivers to save time and money for our clients. For example,

sediment contamination levels at one facility might pose an environmental concern, while the same chemical concentrations at a different site would pose little or no threat to human health or aquatic life. A waterfront owner or operator can save



hundreds of thousands of dollars by focusing resources on those areas that warrant the most attention. Tetra Tech works closely with clients to understand their site-specific needs.

## Integrating Sediment Management and Waterfront Development

Tetra Tech encourages the integration of environmental strategies into the planning and design phases of waterfront development. Proactive planning can save months of permitting time, and maintain the viability of projects that otherwise might stall out during regulatory review. By incorporating sediment management early in the planning process, ports and waterfront developers allow sufficient time to resolve sediment issues within the scope of the planned project or as a component of overall facility planning. They can also address and mitigate environmental risks which may be of concern to lending institutions.

In assisting our clients with sediment management strategies, Tetra Tech considers broad port needs as well as project-specific requirements to encourage the widest possible range of sediment disposal and cleanup solutions. Waterfront owners and operators should consider the following key areas when integrating sediment management into their port planning process:

- ☐ Future development needs (such as upland expansion and increased navigational depth)
- ☐ Current and emerging regulations and permitting requirements
- ☐ Financial institution environmental requirements
- ☐ Innovative approaches to contaminated sediment cleanup

### Waterway Engineering and Construction Services

Tetra Tech offers the following services.

- ☐ Sediment remediation engineering
- ☐ Construction management
- ☐ Dredging design and permitting
- ☐ Geotechnical engineering
- ☐ Embankment design
- ☐ Slope stabilization
- ☐ Wharf design
- ☐ Pier foundation design
- ☐ Seismic analysis and mitigation
- ☐ Pavement design for storage areas and intermodal facilities

## Innovative Approaches to Sediment Management

In projects around the world, Tetra Tech has found that the greatest cost and time savings are achieved when we focus on defining effective cleanup and disposal alternatives. Careful planning in these areas can enhance all other aspects of waterfront planning and development. As a full-service consulting, engineering, and construction company, Tetra Tech has experience with the full range of sediment management solutions, including more innovative approaches which often help keep projects on track. One example is a risk-based approach, which is discussed below.

The overall goal of any approach promoted by Tetra Tech is to limit the amount of disposed materials, and decrease the amount of expensive dredging and disposal.

## Risk-Based Approach

When appropriate, Tetra Tech recommends a site-specific, risk-based approach. This approach ensures that the severity of environmental concern is considered in conjunction with the cost of contaminated sediment disposal. The individual volumes of project sediments can then be ranked based on their level of environmental concern. Instead of disposing of all of the sediment using the most costly alternative, discrete volumes can be disposed of using the most cost-effective cleanup or disposal method.

The model presented below demonstrates the process using a three-level approach to separate high, moderate, and low levels of contaminated sediments.

Because a risk-based approach considers the full range of remediation options, waterfront owners and operators can allocate technical and financial resources to the sediments with the highest contamination and greatest environmental concern, while low and moderate levels of contaminated sediments receive only the level of response they warrant.

Level 1—Determine the volume of sediments both in and outside the dredge area that presents severe ecological and human health concerns (hot spots). Handle these volumes with established methods, such as removal and treatment, upland disposal, or newer more cost-effective methods, such as nearshore confinement.

Level 2—Address moderately contaminated volumes within the dredge area using nearshore fills or nearshore containment. Treat volumes outside the navigation area with more passive methods, such as capping in place.

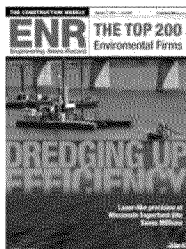
Level 3—Evaluate volumes of low-level contamination within the dredge area (typically the highest volume) for potential nearshore habitat creation or upland creation. Evaluate areas of low-level contamination outside the navigation channel for possible natural recovery or thin layer capping.

### Ecological and Human Health Risk Assessment Services

Tetra Tech is a national leader in providing risk assessment and risk management services:

- ☐ Ecological risk assessments
- ☐ Human health risk assessments
- ☐ Strategic environmental management
- ☐ Risk management
- ☐ Toxicology
- ☐ Risk-based corrective action (RBCA)
- ☐ Air quality
- ☐ Natural resource damage assessment
- ☐ Habitat design

"The Fox River cleanup will be the largest PCB river remediation project in the world," said Christopher Gower, the executive responsible for the Fox River project on behalf of the client. "Effectively removing PCBs from an active river bed poses many technical challenges. We selected Tetra Tech because of their innovative technical approach, their demonstrated ability to address similar world-class environmental challenges, and their ability to work with the project owners to efficiently manage project costs."



## Approaches to Sediment Remediation

Typically, contaminated sediment sites are characterized by small areas of severe environmental concern and large areas of sediments of low environmental concern. Sediments with low levels of contamination located outside of dredge areas may be appropriate for natural recovery.

Ongoing point or non-point sources consisting of permitted or unpermitted outfalls, stormwater runoff, spills, and discharges from vessels are the principal contributors of contaminants found within sediments. To allow the process of natural recovery to work, these sources must be eliminated.

Once sources have been eliminated, natural recovery includes a variety of physical, chemical, and biological processes that can result in the reduction of sediment chemical concentrations over time. These processes include:

- ☐ Burial of contaminated sediments through natural deposition of clean sediments.
- ☐ Mixing of cleaner surface sediments with contaminated deeper sediments by burrowing organisms, ship scour, and natural water currents.
- ☐ Loss of contaminants through biodegradation or diffusion into the overlying water.

Natural recovery processes can be used as:

- ☐ Cleanup action alternatives, either alone or in combination with active cleanup;
- ☐ Cost-effective methods for under-pier or nearshore sediment remediation (where deposition is the controlling process); or
- ☐ Methods to address any residual, isolated sediment cleanup concerns following actions taken to address severe contamination.

### Unconfined Open-Water Disposal

Relatively clean dredge sediments from routine navigational maintenance and dredge sediments of low environmental concern are appropriate for unconfined open-water disposal. Typically, these sediments are barged to a designated disposal site. Sediments with low levels of contamination may also be appropriate for use as upland cover and fill.

### Confined Disposal

Confined disposal is appropriate for both dredge and non-dredge sediments with moderate to high levels of contamination. The objective of confined disposal is to isolate contaminated material and prevent bioavailability. Contaminated sediments can be confined in aquatic, nearshore, and upland environments. Aquatic confinement includes placing



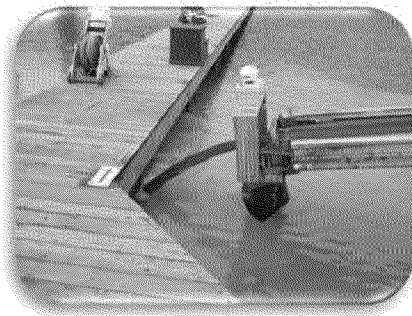
sediments in deeper water within confining berms. The contaminated sediments also can be capped, but the final elevation is always below water.

At nearshore confinement sites, contaminated material is placed behind a berm or dike in a shallow subtidal or intertidal environment created by filling an existing waterway or embayment. To permit future site uses, the final grade is typically raised above high tide. Contaminated sediments that are maintained in a marine environment below the high tide line bind contaminants tightly. This approach is most cost-effective for large volumes of sediments in combination with new upland development needs.

Upland placement of contaminated sediments is the most costly solution. Cost considerations associated with upland placement include containment during dewatering, binding of contaminants, and treatment of runoff water.

## Enhanced Natural Recovery

Enhanced natural recovery (also referred to as thin-layer placement) is a relatively new technique for use in the cleanup of non-dredge volumes. Most active cleanup techniques destroy the population of sediment-dwelling organisms; reestablishment of these populations may take years. Thin-layer placement involves the placement of thin layers (nonconfining) or rows of clean sediment over the contaminated sediment.



This introduction of clean material retains the existing sediment-dwelling populations and attracts new populations to the newly placed material. Thin-layer capping also reduces chemical concentrations in the surface sediments creating further suitable habitat for population growth.

## Permitting Services

Strategic planning should involve permitting issues to avoid costly delays. Tetra Tech provides the following permitting services:

- ☐ NEPA compliance (EIS and EAs)
- ☐ State environmental reviews
- ☐ U.S. Army Corps of Engineers Section 10/ Section 401, Section 404 permitting
- ☐ Coastal Zone Management
- ☐ NPDES permit support
- ☐ Title 5/NPDES air permits
- ☐ Section 106 Historic Preservation Act
- ☐ Section 7 Endangered Species Act compliance
- ☐ Land use permitting

## Numerical Modeling

A practical sediment management program focuses the application of numerical models to solve specific environmental issues. Tetra Tech offers a full range of modeling services to address the following issues:

- ☐ Water quality evaluations
- ☐ NPDES
- ☐ Water Quality Certification (401)
- ☐ Disposal alternative evaluations
- ☐ Open water disposal
- ☐ Nearshore confinement facilities
- ☐ Sediment remediation assessment
- ☐ Natural recovery
- ☐ Contamination mobility
- ☐ Sediment transport
- ☐ Sediment cap effectiveness
- ☐ Hydrodynamics

Spatial components of any of these models can be greatly improved with GIS integration. Tetra Tech is recognized as an expert in this field.

## GIS Mapping and Information Management Capabilities

GIS mapping and information management technologies are widely recognized as powerful tools for a wide range of applications. Tetra Tech offers the following capabilities.

- ☐ GIS
- ☐ Digital data services
- ☐ Demographic mapping
- ☐ Terrain and surficial process mapping
- ☐ Site and facility base maps
- ☐ Remote sensing and photogrammetry
- ☐ GPS surveys
- ☐ GIS spatial modeling
- ☐ Visual simulation



# Project Experience



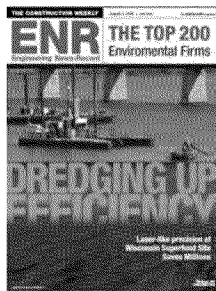
## Fox River Sediment Remediation

GREEN BAY, WISCONSIN

Tetra Tech is performing a sediment remediation project along a 13-mile reach of the Lower Fox River in Green Bay—the largest sediment remediation program awarded in the U.S.

The first phase of the \$700M project comprised the engineering, design, procurement, construction, and commissioning of a 247,000-sf processing facility. Construction of the facility needed to be completed in advance of the winter so installation of the equipment could proceed in a climate-controlled environment. This phase was completed in early Spring 2009, just 14 months after award to meet the remediation start-up deadline of May 2009. Tetra Tech started the full-scale remediation on May 1, 2009, which includes sand separation, dewatering, and disposal, with an estimated project duration of nine years. The project will remediate approximately 7.5 million cubic yard (cy) of PCB-contaminated sediment, the result of decades of industrial uses such as pulp and carbonless copy paper production and recycling mills. The project has been recognized and received multiple awards.

Design and agency approval was required for the centralized sediment processing facility located at the site of a former



bulk fuels terminal, including a sheet pile bulkhead wall that would create four acres of upland, the concept of using three dredges in various parts of the Fox River concurrently, and approval for beneficial reuse of the sand separated from the sediment slurry behind the sheet pile bulkhead. The 30% RD incorporated a dredge plan based on using dredge prisms as opposed to the more cost-effective neat line dredging Tetra Tech would employ.

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“The Fox River cleanup will be the largest PCB river remediation project in the world,” said Christopher Gower, the executive responsible for the Fox River project on behalf of API. “Effectively removing PCBs from an active river bed poses many technical challenges. We selected Tetra Tech because of their innovative technical approach, their demonstrated ability to address similar world-class environmental challenges, and their ability to work with the project owners to efficiently manage project costs.”

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To ensure the May 2009 startup date was achieved, the overall remedial design was segmented into annual work plans so the Tetra Tech team could focus on completing the

### PERFORMANCE HIGHLIGHTS

- Entails the removal of 3.5 million cy of PCB-impacted sediment for a 13-mile reach of the river and placement of nearly 600 acres of capping material to remediate another 4.1 million cy of impacted sediment
- Achieved a total of 1 million hours without a lost time incident
- The Tetra Tech team established an outstanding business relationship with the unions. Each day there were over 300 construction personnel on-site during process building construction in 2008 and 2009
- Met UAO requirement to begin full-scale remediation by May 2009, which was just 14 months after initial contract award
- Completed remedial design concurrent with performance of remedial construction
- Received approval for each of the 28 major deliverables submitted to the regulatory agencies in the 14-month schedule
- Initiated an Adaptive Management/Value Engineering Program geared to generate over \$100 million in project savings in the 10-year implementation period



TETRA TECH

remedial design tasks required to initiate the 2009 field work. A 1,600-activity schedule prepared in Primavera P3 was completed to create a Shared Vision® for the fast track design-build project activities.

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Our Fox River project achieved 1 million work hours without a lost time incident. According to our Project Manager, “The biggest factor in the success of our safety program was to establish a safety culture that included everyone working on site and letting them be an active part of the safety program. Every worker bought into our safety culture and will continue using it on other projects. It is rewarding when you hear workers say they really appreciated our commitment to safety.”

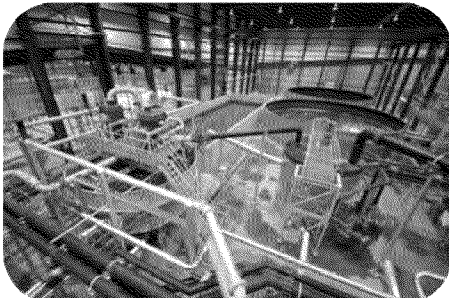
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#### Successful Union Staffing

The Tetra Tech team established an outstanding business relationship with the unions. Each day there were over 300 construction personnel on-site during process building construction in 2008 and 2009. This highly motivated workforce performed the fast-track construction activities safely and with superior quality despite the worst winter weather seen in 25 years in the Green Bay, Wisconsin area.

#### Processing Facility

The 22-acre former bulk fuels terminal was selected as the location for the centralized processing facility from a shortlist of sites evaluated by the Tetra Tech team and Fox River Cleanup Group. The Site Development Plan required construction of a sheet pile bulkhead wall to create 4.4 acres of upland on the east side of the site.



In May 2008, drilling commenced to evaluate the strength of the site soils to support the loads imparted by the new centralized processing facility. The results indicated the site soils were not suitable to support the concentrated loads associated with the membrane filter presses (650,000 pounds fully loaded) and other critical components of the sediment desanding and dewatering, and water treatment systems.

The unsuitable soils were removed and staged on the east end of the site. Over 35,000 tons of stone were imported to replace the 70,000 cy of poor quality soils excavated and staged on-site. A total of 66 H-piles were installed to 105 feet in the water treatment system building footprint. A total of 59 bell caissons with a 4-foot diameter and 9-foot bell bottom were installed to a depth of 60 feet in the building filter press footprint.

The building foundation construction started concurrent with the H-pile and caisson installation. Approximately 25,000 cy of concrete were used in the foundation along with #10 rebar. Over 300 concrete trucks per day delivered concrete for the foundation, footings, and equipment pads. The filter press foundation and deck were formed and poured 29 feet above the caissons to support the eight membrane filter presses and associated hopper & conveyance systems.

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“[Tetra Tech] performed a miracle for us with this design build. When ground broke in late June 2008, every stakeholder and oversight entity claimed the contractor could never erect the processing facility and have it work in time for a May 1, 2009 start-up. Undaunted, the contractor worked to achieve what all regarded as impossible. Seldom does a contractor deliver such an exceptional performance under harsh time constraints, miserable weather conditions, and the constant naysaying of stakeholders and oversight teams.”

Brian Tauscher, General Counsel  
for Argo Wiggins Appleton Ltd., Group, March 2010

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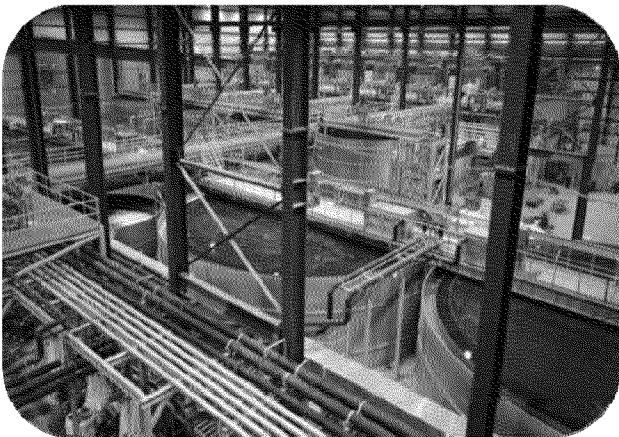




Steel erection started in August 2008 on the building's east side. The steel erection and installation was completed in December 2008, one month after the onset of a severe winter weather. Insulation and the building skin installation were completed shortly afterward so the build out of the interior processing systems could be initiated under cover.

#### Dredging and Dewatering Equipment

Over 120 Conex boxes were delivered to the Port of Menominee, Michigan from Europe and staged in several warehouses in Green Bay, Wisconsin. These boxes contained much of the sediment desanding and dewatering equipment for the process. Tetra Tech worked closely with a European manufacturer to receive, inventory, stage, track, and inspect the enormous volume of pumps, instrumentation, and related valves.



The installation of the process equipment was accomplished from January to April 2009 using as many as 300 craft labor

personnel per day. Installation of the sediment desanding and dewatering facility consisted of four 125,000-gallon clarifiers, four 100,000-gallon sludge storage tanks, a 26,000-gallon slurry pre-thickener tank, a 32,000-gallon sludge residue tank, two 165,000-gallon water effluent tanks, a control room, and eight large plate and frame membrane presses with 188 polyethylene plates each.

A desanding facility was installed consisting of coarse and fine sand separation, classification (washing), and screening (drying). Twenty-five hydrocyclones, four 7,000-gallon classifiers, and four shaker screens were erected in a steel superstructure almost 65 feet high.

The water treatment system was installed concurrently. This system consisted of twenty-four 10,000-pound multimedia filters, six bag filters, eighteen 20,000-pound carbon filters, and three cartridge filters. A 165,000-gallon effluent tank, in-line samplers, and a control room are additional major components of this system.

Tetra Tech and its dredging subcontractor designed a dredging scheme that encompasses three different dredges: a 12-inch hydraulic dredge and two 8-inch hydraulic dredges. Occasionally, a third 8-inch hydraulic dredge is used. The hydraulic-suction dredges excavate contaminated sediment from the riverbed. They are able to do so while implementing a contoured neat line design more efficiently than implementing a dredge prism design using mechanical dredges. Continuous runs of pipe carry the hydraulically dredged slurry from the dredges to the processing facility for up to 10 miles without a buffer pond, an unusual method that requires precise coordination between the dredges and processing plant to keep the slurry flowing smoothly.

The incoming slurry runs through a scalping screen that takes out rocks, wood chips, bottles, and other debris larger than three mm in diameter. Debris is sent to a landfill, and remaining sand, water, and silt move on to the separator and cyclones that remove the sand from the remaining slurry.

The remaining silty water goes to a conditioning tank, where it is dosed with a polymer and coagulant and stirred to

uniform consistency before being pumped into a settling tank. The silt and polymer agglomerate and settle to the bottom as sludge, while the water rises to the top and is pumped to the plant's water-filtration system for cleaning, testing, reusing, or returning to the river. The separated sand is tested and has been approved for beneficial reuse at nearby offsite construction projects.

#### Sediment Remediation

After completion of the processing facility, Tetra Tech implemented the plan of action: the dredging and disposal of approximately 3.5 million cy of contaminated sediment and the installation of a 600-acre capping material to remediate the remaining 4.0 million cy of contaminated sediment. Full-scale remediation began prior to the deadline. During the first season ending November 14, 2009, Tetra Tech dredged 544,535 cy, which was 15% higher than the projected goal. In 2010, approximately 731,017 cy were dredged and processed.

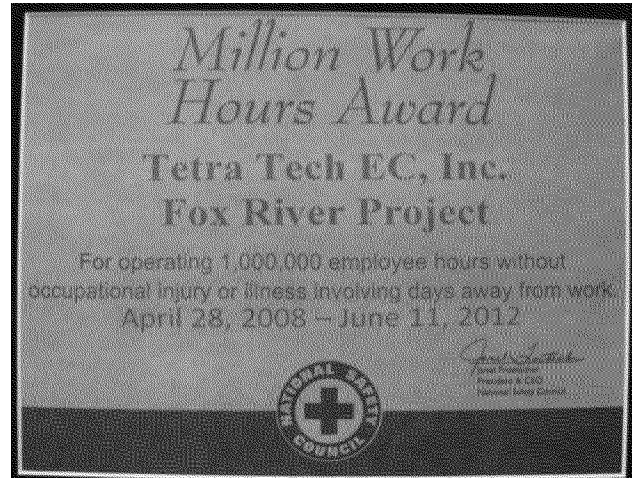
As of December 2011 (the third season), Tetra Tech dredged a total of 1.5 million cy of sediment; hauled 34,688 truckloads totaling 820,808 tons to the landfill; processed 801,192 tons of sediment through the processing facility; treated and discharged nearly two billion gallons of water;

and capped 170 acres of river bottom as well as providing more than 120,000 tons of sand for beneficial reuse.

As the dredging and capping/covering operation came to a close for the winter season and the work totals were tallied, Tetra Tech once again beat the targeted goals for three consecutive years.

#### Safety

As of June 2012, a total of 1 million hours have been completed without a lost time incident.





## Alcoa Vancouver Sediment Remediation Project

WASHINGTON

Alcoa, Inc. (Alcoa), a world leader in the production and management of primary aluminum, fabricated aluminum and alumina combined, contracted Tetra Tech in 2008 to provide remediation services to clean up polychlorinated biphenyl (PCB)-contaminated sediments along a 2,300-linear foot stretch of the Columbia River in Vancouver, Washington.

Valued at \$12 million, this project's scope of work involved the removal and disposal of 48,000 cubic yards (cy) of contaminated sediment, and 20,000 tons of soil and debris from the river bank, as well as the placement of 38,000 cy of enhanced natural recovery sand cover cap. Tetra Tech also worked to restore 2,300 linear feet (lf) of shoreline with bedding material, installed riprap for shoreline protection, removed 1,500 tons of asbestos-contaminated soils from the shoreline, and established vegetation on the shoreline above the riprap/shoreline protection level.



By coordinating project work activities with an ongoing demolition project, and accelerating aspects of the schedule with overtime and weekend shifts, Tetra Tech completed this project on time and within budget, even while faced with bad weather conditions and permit delays. The team completed this project within the Columbia River "fish window," and removed an additional 7,000 tons of Subtitle C waste, 7,000 tons of Subtitle D waste, and more than 1,500 tons of soil contaminated with asbestos within the original schedule timeframe. Tetra Tech was able to save the client several million dollars by completing the project in one work session, with a total of 27,899 accident-free hours worked.



### PERFORMANCE HIGHLIGHTS

- Cleaned up PCB-contaminated sediments along a 2,300-linear foot stretch of the Columbia River under MTCA framework
- Tetra Tech removed and disposed 48,000 cy of contaminated river sediment, and 20,000 tons of soil and debris from the river bank, and placed 38,000 cy of enhanced natural recovery sand cover cap
- Completed the project within the Columbia River "fish window"; ensured compliance with project environmental plans (e.g., SPCC, SWPPP, and Waste Management Plan), health and safety, and sampling and analysis plans for the project conducted under Washington State Consent Decree.
- Removed an additional 7,000 tons of Subtitle C waste, 7,000 tons of Subtitle D waste, and 1,500 tons of soil contaminated with asbestos within the original schedule timeframe

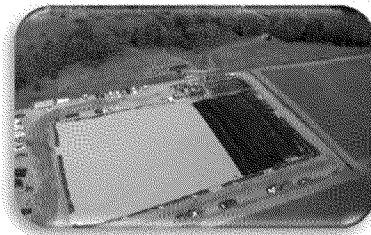




## Enbridge Energy/Submerged Oil Assessment / Remediation, Kalamazoo River

MARSHALL, MI

On July 26, 2010, Enbridge Energy Partners LLP (Enbridge) reported a release of more than 800,000 gallons of heavy



crude oil and condensate in Marshall, MI, due to a pipeline failure. This release, unprecedented in size in the State of Michigan, entered the Kalamazoo River (a navigable waterway) after moving through one of its tributaries, the Talmadge Creek. Because it coincided with a 25-year storm event, the release eventually impacted more than 3,000 floodplain acres by the time the waters receded and a 1,000 acre footprint within a 40 mile reach of the Kalamazoo River.

Enbridge quickly mobilized teams from Canada and the U.S. and initiated emergency response actions per a U.S. EPA issued order. In total, more than 2,000 workers converged on Marshall to assist in the clean-up, deploying nearly 15,000 feet of boom and collecting over 13,060,000 gallons of oil/water.

Following the incident, Enbridge recognized the need to address a great volume of submerged oil in the surface sediment of the Kalamazoo River System. The submerged oil was thought to span approximately 40 miles of the

Kalamazoo River System including Morrow Lake located at the far western end of the entire river reach.

Enbridge contracted with Tetra Tech – considered experts in riverine system mechanics and modeling – to assess, locate, characterize, and map the submerged oil impact in surface water and sediments, and evaluate remediation technologies. Taking advantage of company-wide resources, Tetra Tech mobilized approximately 30 personnel from across the country in disciplines such as fluvial geomorphology, forensic chemistry, ecology, environmental science, design engineering with sediment experience, hydrography, hydrodynamic modeling, and risk assessment to staff submerged oil recovery assessment, ecological reconnaissance, and hydrographic survey teams. Tetra Tech's staff was on-site within hours of being contacted by Enbridge. In addition to personnel, Tetra Tech quickly provided company-owned survey vessels with sophisticated electronic equipment, specialized sediment sampling equipment, extensive PPE and support equipment required to execute the work.

The level of effort required all project staff to work seven days per week in 12+ hour shifts. During the first four weeks of the project, most staff worked 14- to 16-hour days. Night-time work was typically not undertaken out of consideration for local residents.

### PERFORMANCE HIGHLIGHTS

- Client satisfaction generated numerous follow-on contracts, including operation and management
- Company-wide resources produced a team of 30 experts to staff a five-crew geomorphology sampling team, five submerged oil removal assessment teams, and dredging oversight staff
- Work was completed within the original budget and in the time allotted by regulators, which included USEPA Region 5, MDNRE, NOAA, USFWS and local and county entities for this fast-track design-build response action
- The project approach and work plan prepared by Tetra Tech was approved by agency personnel in a few days with minimal comments.
- The 1-foot dredging neatline was achieved over the 6-acre footprint by the hydraulic dredging subcontractor minimizing removal volume.
- The dredging, dewatering, and water treatment was accomplished in 21 days for 20,000 in situ cy over 6 acres.
- The sediment dewatering accomplished in geotextile tubes required no additional additives for off-site disposal in a landfill. The paint filter test was satisfied right out of the bags for off-site transportation and disposal.
- Water quality guidelines were maintained over the entire project timeframe using a 2-stage turbidity curtain.
- All geotextile tube weep water was successfully treated and discharged back to the river per NPDES permit requirements.


**TETRA TECH**

Among the tasks performed for this time-sensitive project were:

- Construction oversight of treatment systems
- Recovery of submerged oil by aeration and agitation of sediment
- Hydraulic dredging operation and collection of submerged oil from surface water oversight
- Sediment sampling, sediment core logging, poling, and sampling preparation for lab analysis
- Geomorphic mapping and analysis
- Hydrodynamic modeling
- Client and regulator updates
- Operations and maintenance
- Presentations at Public Meetings

Of special value, according to the client, was Tetra Tech's ability to anticipate construction issues such as "drainage pad construction, water treatment system installation, and multiple dredge use ahead of construction schedule" as well as provide "Excellence in health and safety operations...and innovative solutions...to overcome obstacles."

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**"...sincere thanks for all your dedication and focused attention to this project. I believe the level of effort and professionalism demonstrated by the Tetra Tech team allowed us to reach our goal ahead of schedule and brought the issue of submerged oil to the surface (pardon the pun)! ... The field crews and the work they did on this was imperative to our success. They all did a superb job." - Karl F. Beaster, Environmental Analyst, Liquids Pipelines Environment, Enbridge Energy**

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#### Qualitative and Quantitative River Assessments

Tetra Tech quickly initiated a desk top study of the Kalamazoo River System to plan a geomorphic-derived investigation. The work was planned based on the river and creek characteristics and not geospatially on a grid system. This approach resulted in a focused, cost-effective data collection effort for submerged oil. Enbridge initiated the submerged oil recovery in approximately 30 priority areas along the 40-mile river reach. Field results correlated closely with the original desktop study, resulting in excellent cooperation by agency personnel. Qualitative and Quantitative Assessments were performed on the Kalamazoo River System to identify priority areas of submerged oil based on quantity and remobilization potential of the submerged oil

This work consisted of poling thousands of locations and collecting over 550 sediment cores for logging and sampling among other activities (poling map shown on next page).

Tetra Tech worked quickly to prepare detailed, yet concise daily river maps and work plans while working closely with regulators to obtain approvals, receiving minimal comments on our deliverables. The field investigation results mirrored our forecasts provided in the desk top study.

#### Recovery of Submerged Oil and Dredging Activities

Tetra Tech successfully executed the investigation/remedial requirements approved by the US EPA, and as a result the company was later engaged to evaluate efficient, cost effective remedial technologies and oversee the implementation of submerged oil and oil-impacted sediments recovery. Our work during this stage included highly specialized dredging methods (e.g., the use of a shallow water, high solids Amphibex [see photo] that was necessary due to the shallow depth of the Kalamazoo River). The dredging effort was successful based on high quality planning and design work. In the planning stages of the dredging work, Tetra Tech ran bench scale chemistry tests to support the design of a treatment system for the dredged sediment. A treatment system for the dredged sediment weep water was developed and built. Tetra Tech calculated the necessary quantity and volume of geotubes needed to consolidate the dredged sediment. The material consolidated very well and passed the "paint filter test" on the first attempt and thus no costly drying agents were needed prior to disposal. Tetra Tech developed daily

progress maps (shown on the next page) used to track the progress of the dredging.

Furthermore the client and regulators increased the scope of work (additional

removal areas) while reducing the schedule. Our team mobilized two additional pieces of dredging equipment and personnel in less than one week to meet that new, aggressive schedule.



Poling Map



Daily Progress Map

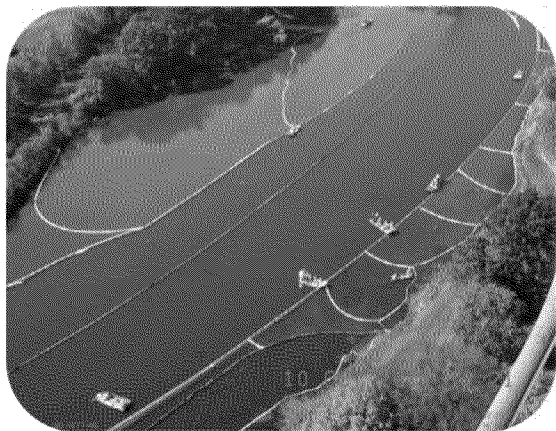


Tetra Tech's Quality Control oversight of all submerged oil recovery activities included on-site support staff to document the removal activities – aeration and agitation, raking, flushing, water washing (due to the sensitive ecosystem and shallow River conditions) and other such techniques.

Enbridge was granted permission to restart this pipeline following a 2-month shutdown, but the work at this site continued and Tetra Tech's role was ultimately expanded to include operations and management throughout the following winter. Tetra Tech's scope grew to become heavily



involved in the Operations and Maintenance (O&M) effort which transitioned the summer and fall activities into winter activities. This included oversight of O&M field activities, preparation of O&M work plans and other winter work plans to safely and efficiently continue with clean-up activities. Enbridge selected a Tetra Tech Construction and Project Manager to be an O&M Site Manager for a 12- to 24 month long term on-site position. Furthermore, the scope has grown to include a completion of an oiled tree study and the development of a Conceptual Site Model which will be used to support remediation activities in 2011.



*Aeration Area, October 10, 2010*

Though this project entailed emergency operations undertaken quickly and with multiple regulatory agencies and concerned parties, Tetra Tech was able to deliver this project ahead of schedule and with zero health and safety incidents.

#### Forensic Chemistry

Enbridge has requested that Tetra Tech provide forensic chemistry support for the project. The deliverables associated with this work are Attorney/Client Privileged and release of all or a portion of the information is at Enbridge's discretion and include the following services:

- Contaminant Source Determination and Allocation
- Natural Resources Damage Assessment Defense
- Fate & Transport Determinations/Assessments

An analysis of alkylated PAHs and forensic evaluation of parent PAH source ratios will be performed to assess potential sources and allocations of contaminant materials in the sediments. Additional scope to support Natural Resources Damage Assessment Defense and additional Fate

& Transport Determinations/Assessments, if warranted, will be developed in concert with Enbridge at a later date based on project needs on an as needed basis.

#### Analysis of Alkylated PAHs

To support the forensic chemistry effort, the crude oil from the spill and river sediments will be analyzed for the following:

- Hydrocarbon fingerprint by GC/FID (EPA Method 8100, ASTM D 3328-90).
- Selected extended PAH profiles (EPPs) by GC/MS/SIM (EPA Method 8270 mod., ASTM D 5739-95).
- Biomarkers by GC/MS/SIM (EPA Method 8270mod).
- Selected parent PAH compound specific stable isotope ratios (CSIR).

#### Evaluation of Characteristic PAH Source Ratios

The ability to determine the source of PAHs to the environment has been shown to be possible through the use of the ratio of different PAH compounds, and the application of this technique has become a common accepted practice in the environmental forensic scientific community.

We will evaluate a minimum of two characteristic PAH source ratios for potential source determination and an allocation within the background and sediment samples collected in 2010 response to the spill incident.

#### Natural Resources Damage Assessment Defense

Tetra Tech will provide the results of the forensic chemistry analyses and evaluations for use in the determination of the allocation of additional identified sources, not related to the Enbridge spill. These will help focus the Natural Resources Damage Assessment Defense so that legacy contaminants from sources not attributable to the Enbridge crude oil spill incident are excluded from the Natural Resources Damage Assessment.

**Public Involvement.** Tetra Tech was the only contractor invited by Enbridge to participate in public meetings and gatherings. This included presenting project activities on several occasions with and on behalf of Enbridge to large groups at local and regional public meetings.



## Head of the Thea Foss Waterway Sediment Remediation

TACOMA, WASHINGTON

PacifiCorp Environmental Remediation Company contracted with Tetra Tech to develop a cost-effective sediment remediation design (dredging and capping



remedy) for the Head of the Thea Foss Waterway in Tacoma, Washington. The project included development of the construction monitoring and long-term operation, maintenance, and monitoring plans on an expedited basis. Tetra Tech performed a multi-beam hydrographic survey of the site to establish pre-remedy site conditions, assisted with contractor selection, and provided design support during remedial construction. Tetra Tech continues to perform post-construction long-term sediment cap monitoring of the 9-acre site including multi-beam hydrographic surveys, sediment sampling, and visual monitoring. The project design elements included: limited dredging of impacted sediments in shallow water; transfer to, and management of, dredge material at an approved upland facility; placement of an impermeable cap over the active non-aqueous phase liquids (NAPL) seep area; capping of soft sediments; armoring of areas subject to propeller and outfall scour; and habitat improvements.

Objectives for the project included: meeting the established cleanup goals; meeting the regulatory construction completion date; providing a cost-effective cap design for the

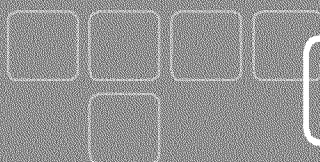
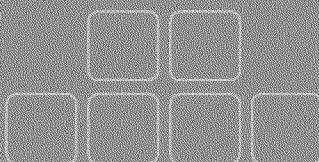
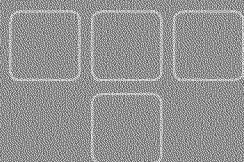
active NAPL-seep area and surrounding impacted sediments; maintaining the required water depth for navigation; minimizing disruption to operating facilities adjacent to and within the remediation area; and reducing the long-term liability associated with this project site. Challenges, in addition to the active seep area that were addressed during design, included two active 96-inch municipal storm water outfalls discharging within the project area, slopes with very low existing factors of safety and ongoing seismic concerns related to these slopes, and coordination with two adjacent remediation projects.

To satisfy the project objectives and resolve the specific challenges and unique features of this site, Tetra Tech developed Technical Memoranda regarding key issues related to the technical design for stakeholder review and



### PERFORMANCE HIGHLIGHTS

- Overall project costs were reduced by approximately \$8M through redesign of the cap to provide a unique impermeable cap to control active NAPL seeps
- Through value engineering efforts and use of innovative cap design (an impermeable cap in areas of active NAPL seeps), Tetra Tech reduced the projected costs from \$25M to \$11.5M, including projected long-term maintenance and monitoring costs
- Remedy construction was completed in February 2004, one year ahead of the schedule set by the regulators



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approval as the design progressed. This cooperative approach ensured the assumptions and criteria used to develop the final design package were already vetted and the final design would receive regulatory approvals. The Technical Memoranda approach was extremely useful in advancing the unique impermeable cap and slope stability elements of the design. Coordination with adjacent projects and facilities within the project area was accomplished through regular communication, including progress meetings and mutual review of intermediate design deliverables. Our project approach included assisting our clients with contractor selection in parallel with the project design efforts to advance the project schedule and ensure adherence to the strict regulatory timeline requirements.

Overall project costs were reduced by approximately \$8M through redesign of the cap to provide a unique impermeable cap to control active NAPL seeps. Additional cost savings were realized by contractor involvement in the final design development through early selection of the contractor. This early selection helped to ensure design constructability. Also, dredging in the remedy area was limited to areas where cap placement would interfere with facility operations, required navigation depth, or placement of scour protection. This reduced dredge material handling and management costs and associated liabilities.

In late 2002, when Tetra Tech was awarded this challenging project, the estimated construction cost was \$25M, including projected long-term maintenance and monitoring costs. Through value engineering efforts and use of an innovative cap design, Tetra Tech reduced the projected costs to \$11.5M.

Project risks were managed throughout the project through identification of cap material sources, pre-acceptance of the project wastes by the waste management facility, development of Technical Memoranda, implementation of construction monitoring plans (performance verification and water quality monitoring plans), and ongoing long-term monitoring. It included monitoring of the site after a trigger

event such as an earthquake or storm exceeding the design storm, in addition to scheduled monitoring activities.

A regulatory requirement for remedy construction completion was established for February 2005. Tetra Tech completed the redesign on an expedited schedule and obtained necessary regulatory and stakeholder approvals in late summer 2003. Construction began in early fall 2003 and remedy construction was completed in February 2004, one year ahead of the schedule set by the regulators.



## Middle River Remedial Investigations and Feasibility Study

MIDDLE RIVER, MARYLAND



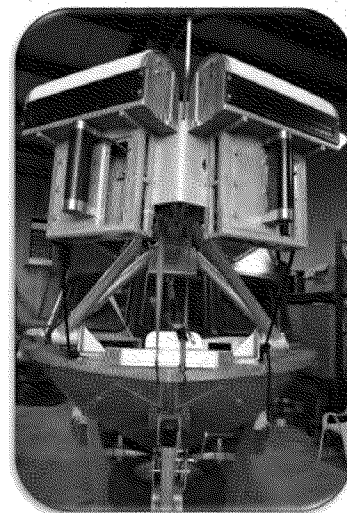
Tetra Tech was contracted to perform site characterization investigations and risk assessments to provide the information on the

nature and extent of contamination, the nature of ongoing sources of contamination, the physical and chemical properties that influence the fate and transport of contaminants found at the site, and the risks to human health and the environment. Tetra Tech also conducted a feasibility study that describes and evaluates a range of remedial alternatives to address site risks through remediation of sediment contamination at the site. A recommended alternative for a final remedy is also provided in the feasibility study.

Contaminated Sediment and Surface Water Investigations. On-going sediment and surface water investigation in water bodies adjacent to a manufacturing facility that has been in operation since 1929. The investigations focus on impacts from past manufacturing and disposal practices including former land-based dump sites. Tetra Tech designed sampling and analyses workplans and executed investigations to evaluate the potential presence of contaminants potentially being discharged via surface water runoff and ground water discharge. The results

of the investigations have allowed a holistic approach to assessing overall impacts to an important part of the Chesapeake Bay.

Bathymetry Survey. Tetra Tech's marine mapping group provided a bathymetry survey for the Middle River Complex. Detailed and extensive survey data were collected to support the sediment remedial investigation and design efforts within the Middle River, Maryland.



The Research Vessel (R/V) Storm, a 21-foot jet boat configured with dual multibeam echosounder (MBE) systems was mobilized to the site and operated by a Tetra Tech USCG-licensed boat captain. Marine mapping staff for this survey mapped the site's bathymetry and characterized bottom conditions of Dark Head Cove, Cow Pen Creek, and their confluence area, as well as provided mudline elevations to support sediment studies and potential remedial actions at Middle River Complex.

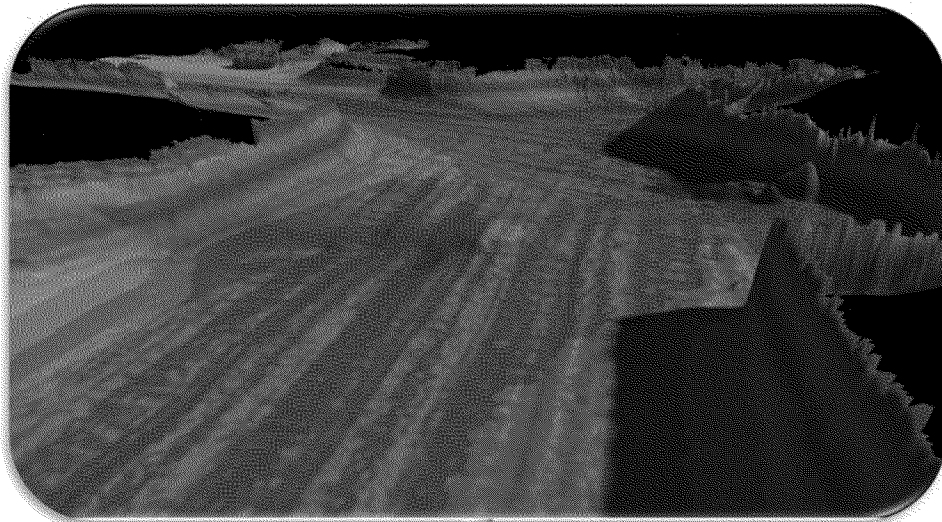
The Middle River bathymetry survey mapped in high detail the morphology of Dark Head Cove and, to the extent

### PERFORMANCE HIGHLIGHTS

- Remedial investigations including collection and analysis of sediment and tissues samples, geotechnical samples, hydrodynamic modeling, human health and ecological risk assessments
- Feasibility study based on risk-based RAOs and PRGs; evaluated a range of alternatives; selected a combined action remedy
- Overcame challenges associated with dense bottom vegetation
- High-resolution multibeam bathymetric survey provided data to support remedial investigation for contaminated sediments


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possible with the presence of dense vegetation, Cow Pen Creek. The water depths within the survey area ranged from 0.5 to 13.7 and averaged 8.8 U.S. survey feet as referenced to NAVD88. These data, which have been gridded at 3x3 feet, provided mudline elevations for the site which can be used for sediment transport modeling. The mudline elevations can also be used to support dredge or capping design efforts, design dredge cuts and to calculate dredge and capping volumes. Obstructions/debris on bottom can be identified within the data, including docks, aquatic vegetation and boat ramps.



Human Health and Ecological Risk Assessments of Sediment Contamination Middle River, Maryland. Tetra Tech performed Human Health and Ecological Risk Assessments for sediment contamination including metals, PCBs, and PAHs at site bordering an estuary off of Chesapeake Bay. The site has high visibility with regulatory agencies and the public due to the national focus on the health of Chesapeake Bay. Results of the risk assessments are being used in a feasibility study to develop an approach to remediation of the affected sediment.

Surface Water and Sediment Investigation Frog Mortar Creek, Middle River Maryland. Tetra Tech completed a three-phase investigation in Frog Mortar Creek, located in Middle River, Maryland in the portion of the creek which is adjacent to an

approximately 50 acre area where historical dumping activities occurred. The objective of the Phase I investigation was to identify potential groundwater discharge zones by identifying temperature and conductivity differences between the surface water and groundwater utilizing a Trident probe and to collect porewater samples from these selected areas. The objective of the Phase II surface water and sediment program was to characterize areas of groundwater seepage into the surface water body and to obtain analytical data to quantify the presence or absence of contaminants in Frog Mortar Creek which may be related to groundwater

transport or erosion of soil from the dump site. The objective of the Phase III surface water and sediment program was to evaluate potential contamination in nearshore and offshore sediment.

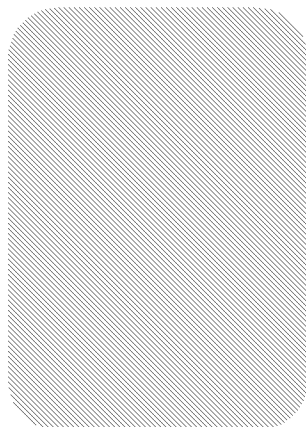
Feasibility Study, Middle River, MD. Tetra Tech was responsible for development and design of remedial alternatives, including dredging, capping, enhanced natural recovery, environmental footprint an sustainability analysis, geotechnical engineering support

for site investigations, production of engineering drawings and cost estimates, public involvement support. During the Feasibility Study, Tetra Tech worked closely with the client and regulatory agencies (i.e., EPA, MDE) to develop expedited and streamlined remedial strategies for the site and oversaw the preparation of Feasibility Study. Conducted the FS evaluations by developing preliminary remediation goals, screening remedial technologies, developing remedial alternatives, and evaluating and identifying a preferred remedial alternative.

## New Bedford Harbor Superfund Site Risk Assessment, Field Sampling, Pilot Testing, Design of Sediment Remedies

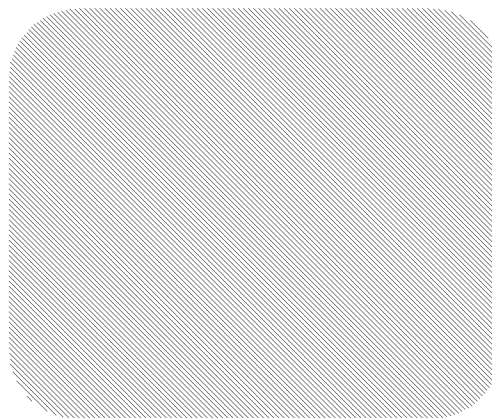
MASSACHUSETTS

Tetra Tech, Inc. (Tetra Tech) has developed cost-effective remedial solutions for the New Bedford Harbor Superfund site. The site consists of 18,000 acres of estuary, harbor, and bay areas contaminated with PCBs and metals (including lead, cadmium, chromium, copper, and PAHs) - including contamination in sediments over a widespread area and in several species of marine biota. Specific tasks performed included human health and eco risk assessments, as well as technical and financial risks associated with potential remedies, on-site pilot tests of innovative treatment technologies for PCBs and heavy metals contamination, field sampling and data management, and remedial designs for both Confined Disposal Facilities (CDFs) as well as dredging/dewatering and wetlands restoration solution.



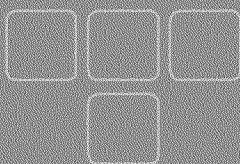
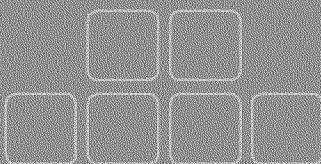
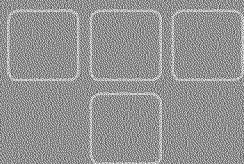
### Risk Assessment Tasks Included:

- Examination of technical and financial risks associated with various treatment technologies
- Fate and transport modeling
- Factoring of potential widespread remediation and destruction of productive wetland areas into consideration of cleanup levels
- PCB air management program to ensure a clean workable approach that would protect the public while minimizing field operational problems



## PERFORMANCE HIGHLIGHTS

- Designed dredging/dewatering/wetland restoration solution.
- Designed CDF remedial solution which included removal (hydraulic dredging) and containment (in a series of four CDFs).
- Achieved a \$6.7 million cost savings and a 9-month schedule reduction in the stabilization, removal, and disposal of "hot spot" contaminated sediments. The overall potential savings from higher production rates, better dredging accuracy, and better management of overall solids and water treatment is projected at more than \$15 million.
- Responsible for a feasibility study for mechanical dewatering of sediments to be dredged from the harbor. Results of this investigation and subsequent bench scale tests indicated dredged sediments could be effectively mechanically dewatered.
- Initiated an alternative analyses for evaluating the dewatering, transport, and disposal of the contaminated sediments to TSCA off-site disposal facilities as opposed to on-site CDFs. This alternative was evaluated by USACE and the EPA and approved, resulting in a potential of saving \$52 million.
- Collection of over 1,900 sediment borings ranging from 2 to 15 feet in depth in wetland, intertidal, and subtidal areas in the harbor. Data was used to create a GIS database and implement a geostatistical analysis in order to delineate the extent of PCB contamination in the New Bedford Harbor Acushnet River and surrounding wetlands.



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Factors considered in developing the approach included:

- Nature and extent of contamination
- Risks to human health and the environment
- Range of applicable remedial technologies including the risks associated with implementation and performance, present and future land-use
- Functioning and future value of the site's ecosystems and natural resources
- Other stakeholder considerations

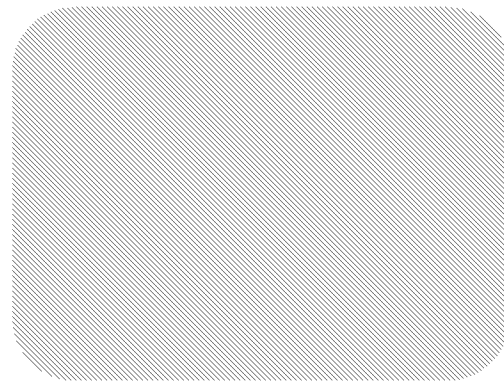
Field Sampling Tasks Included:

- Planning, method development, sampling, and delineation of PCB contamination in the harbor
- Responsible for completion of multiple contaminated sediment sampling events
- Collection of over 1,900 sediment borings ranging from 2 to 15 feet in depth in wetland, intertidal, and subtidal areas in the harbor
- Sampling methods included auger, split spoon, gravity core, vibracore, and box core methods
- Sampling points were located using digital global positioning to ensure accuracy to less than one foot
- Data was used to create a GIS database and implement a geostatistical analysis in order to delineate the extent of PCB contamination in the New Bedford Harbor Acushnet River and surrounding wetlands

**Tetra Tech initiated an alternative analyses for evaluating the dewatering, transport, and disposal of the contaminated sediment to TSCA off-site disposal facilities as opposed to on-site CDFs. This alternative was evaluated by USACE and the EPA and approved, resulting in a potential of saving \$52 million.**

Pilot Testing Included:

- Evaluation of the complete range of treatment and containment options (including both on-site and off-site solutions) for Hot Spot sediment contamination
- Technical approach for treatability testing developed with input from a "Forum" group including federal and state regulators and local stakeholder groups (goal was to provide information required to assess the performance risks associated with each technology and concerns identified by the Forum group)
- Evaluation of the commercial viability of process scale up including full-scale treatment cost/schedule



**Tetra Tech was responsible for a feasibility study for mechanical dewatering of sediments to be dredged from the harbor. The purpose was to determine the technical feasibility and cost-effectiveness of mechanical dewatering. The study included evaluation of potential mechanical dewatering systems, potential material separation processes, and bench scale testing of several dewatering processes. Bench scale dewatering testing was conducted for the plate and frame filter press, high intensity pressure (HIP) belt press, and belt filter press.**

**The results of this investigation and subsequent bench scale tests indicated dredged sediments could be effectively mechanically dewatered.**

CDF Remedial Solution Included:

- Removal (hydraulic dredging) and containment (in a series of four CDFs) of 45,000 cubic yards of PCB-contaminated sediment
- Largest CDF was designed to support local marine industry, with the other CDFs adding a green-belt area along the otherwise industrial shoreline of New Bedford
- Developed an innovative photo-simulation technique to illustrate what the shoreline CDFs would look like once constructed, thus allowing numerous potential scenarios to be fully evaluated by various project stakeholders

Dredging/Dewatering/Wetland Restoration Solution Includes:

- Design of sediment dredging, wetland restoration, and sediment treatment by mechanical dewatering and water treatment



- Preparation of detailed calculations, Basis of Design and Design Analysis reports, and detailed drawings and specifications
- Design included innovative dredge equipment necessary to remove thin layers of contaminated sediments in shallow water with minimum re-suspension
- Treatment included desanding and mechanical dewatering of fine-grained, organic sediments
- Design of a desanding/dewatering facility capable of producing up to 816 cy of dewatered sediments
- Process includes sediment desanding, polymer addition, mechanical dewatering, and off-site transportation and disposal by rail and/or truck
- Design was based on the results and conclusions of the feasibility study and additional bench scale testing
- Design, construction and operation of a 700 to 2,000 gpm water treatment facility for process waters generated during dredging and mechanical dewatering of PCB-contaminated sediments
- Water treatment system components include chemical addition, inclined plate clarification, sand filtration, polishing filtration, and carbon adsorption

**Tetra Tech achieved a \$6.7 million cost savings and a 9-month schedule reduction in the stabilization, removal, and disposal of “hot spot” contaminated sediments. The overall potential savings from higher production rates, better dredging accuracy, and better management of overall solids and water treatment is projected at more than \$15 million.**

#### Construction Activities Included:

- Installation of 750 linear feet of 6'x8' concrete box culvert, cast-in-place transition structures, and outfall structures
- Excavation and restoration of over 30,000 square feet of wetlands located in a residential area
- Field investigations included sediment sampling, geotechnical drilling, dredge field tests, water treatment plant pilot testing, land surveying, wetland delineation, and cultural resource field surveys



## Tittabawassee River Project

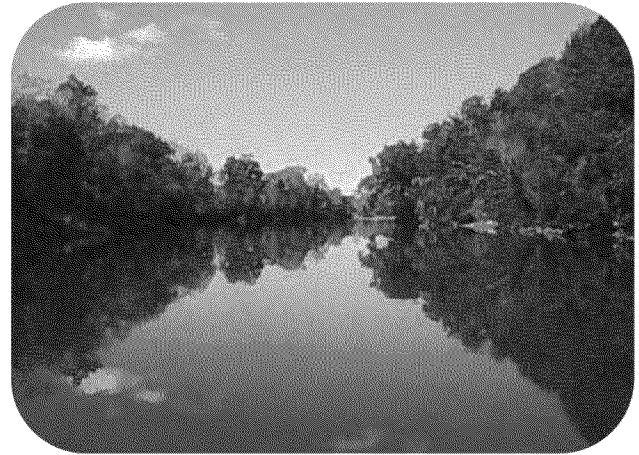
MICHIGAN

In 1895, a company developed a chemical process to produce chlorine on the banks of the Tittabawassee River in Michigan. A by-product of the chlorine production was dioxin and furans, which were discharged to the river from 1895 through the better part of the 20<sup>th</sup> century. The chemical plant grew and added other chemical processes with additional by-products. The requirements to discharge to the river changed in 1972 with the implementation of the Clean Water Act. The Tittabawassee River is 24 miles long from Midland, MI to the confluence with the Saginaw River.

To explain the distribution of contaminants in the river and across the floodplains and quantify potential risks of remobilization, it was necessary to understand the historical development of the river and how the river has responded to changes in boundary conditions. The complexity of geomorphologic, hydrologic, and geochemical processes together with site-specific river processes required a tailored strategy combined with specific process investigation layers to successfully evaluate and understand the river.

This integration of fluvial geomorphologic principles and risk analysis in a riverine environment coupled with a practical approach to remedial investigation, design and implementation was performed. The process centers on characterizing the depositional and erosional dynamics in river environments to understand the transport of sediments through the river system. The purpose of the investigation

was to determine the nature and extent of dioxin and furan contaminated sediment (primary constituents of interest (COI)) and more than 200 other chemicals (secondary COI) in the river and floodplain.



The Tittabawassee River remedial investigation (RI) included a comprehensive geomorphic assessment of the river's stability, quantifying the annual sediment load of the river and its ability to move the sediment, determining the existing river's evolutionary state, and evaluation of the effects of ice on sediment transport.

Additional lines of information were also collected and integrated into the RI, including river morphology, river stability, release history, and anthropogenic influences. The overall distribution of primary and secondary COI is linked to

### PERFORMANCE HIGHLIGHTS

- Large dioxin-contamination project where we used the GeoMorph® approach to remedial investigation, design, and implementation
- Sediment contaminated with dioxin, chlorinated furans, and over 200 other chemical COI
- During the unprecedented 3-year field investigation of the Tittabawassee River, the characterization of the nature and extent of COI in river sediments and floodplain soils along 24 river miles and over 8,000 floodplain acres was used to support early actions implemented to remove hot spots in the river and floodplain
- Collected over 11,000 cores, resulting in 24,715 samples and 20,200 analyses for primary and secondary COI



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river processes, natural river evolution and historical anthropogenic influences on river hydrodynamics. In 2008, the Tittabawassee River RI was successfully completed under collaborative work plans and agreements between The Dow Chemical Company and the State of Michigan Department of Environmental Quality.

The Tittabawassee River project is frequently cited by Federal, state, and local interest groups as an example of how contaminated rivers investigations should be conducted.

The implementation has proven to be both highly cost-effective and well accepted by State and Federal Regulators. During the unprecedented 3-year field investigation of the Tittabawassee River, this process was successfully used to map the river morphology and characterize the nature and extent of primary and secondary COI in river sediments and floodplain soils along 24 river miles and covering more than 8,000 floodplain acres.

During the 3-year effort, more than 11,000 cores were collected, resulting in 24,715 samples and more than 19,000 analyses for primary COI and 1,200 analyses for secondary COI.



The comprehensive, river process-based fate and transport investigation methodology, together with an extensive understanding of the complex contaminant release history and anthropogenic influences, was successfully utilized to satisfy the RI requirements for the Tittabawassee River. This high-profile project has moved from the RI phase to Feasibility Study (FS)/engineering evaluation/ cost analysis (EE/CA). The results have been successfully used to implement several large early action hot spot removal efforts in the river and floodplain.

